



Pedro Araujo Villarinho

**A Simheuristic Algorithm for the Stochastic
Permutation Flow-Shop Scheduling Problem
with Delivery Dates and Cumulative Payoffs**

Supplementary Material

Supplementary material of thesis presented to the Programa de Pós-graduação em Engenharia Industrial da PUC-Rio in partial fulfillment of the requirements for the degree of Mestre em Engenharia Industrial.

Advisor : Prof. Luciana de Souza Pessoa
Co-advisor: Prof. Fernando Luiz Cyrino Oliveira

Rio de Janeiro
May 2020



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1 Supplementary Material

1.1 Deterministic Environment Results

On this Section the deterministic environment results are shown. Each Table contains the 150 instances mentioned in Section 5.1. For each instance, the best solution provided by FF heuristic (Fernandez-Viagas and Framinan.[1]) and their deviation with FF-ILS proposed by Pessoa and Andrade.[2] and the proposed methods (BR-FF and BR-FF-VND) were illustrated for different computational times.

Relative Percentage Deviation of the Best Solution and Average of the Best Solutions on Deterministic Environment

1 minute Instance	FF BestSol	FF- GRASP BestDev	FF- GRASP AvgDev	FF-ILS BestDev	FF-ILS AvgDev	BR-FF BestDev	BR-FF AvgDev	BR-FF-VND BestDev	BR-FF-VND AvgDev
k1a0.1r0.1	20.00	0.00	0.00	0.00	0.00	5.00	0.50	5.00	5.00
k1a0.1r0.3	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.1r0.5	20.00	5.00	5.00	5.00	1.00	5.00	5.00	5.00	5.00
k1a0.1r0.7	14.00	21.43	21.43	21.43	13.57	28.57	17.14	21.43	21.43
k1a0.1r1.0	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.1	45.00	0.00	0.00	0.00	0.00	2.22	2.22	2.22	2.00
k1a0.3r0.3	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.5	46.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.7	46.00	2.17	2.17	0.00	0.00	2.17	2.17	2.17	2.17
k1a0.3r1.0	43.00	0.00	0.00	0.00	0.00	2.33	2.33	2.33	2.33
k1a0.5r0.1	65.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.5r0.3	63.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.5r0.5	67.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.5r0.7	65.00	0.00	0.00	0.00	0.00	1.54	1.54	0.00	0.00
k1a0.5r1.0	59.00	0.00	0.00	0.00	0.00	1.69	1.69	1.69	1.02
k1a0.7r0.1	80.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.37
k1a0.7r0.3	80.00	1.25	1.25	0.00	0.00	1.25	1.25	1.25	1.25
k1a0.7r0.5	80.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.7r0.7	79.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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1 minute	FF	FF- GRASP		FF-ILS		BR-FF		BR-FF-VND	
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k1a0.7r1.0	78.00	1.28	1.28	0.00	0.00	1.28	1.28	1.28	1.28
k1a1.0r0.1	99.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a1.0r0.3	98.00	1.02	1.02	1.02	0.51	0.00	0.00	1.02	1.02
k1a1.0r0.5	98.00	1.02	1.02	0.00	0.00	1.02	1.02	1.02	1.02
k1a1.0r0.7	97.00	1.03	1.03	0.00	0.00	0.00	0.00	1.03	1.03
k1a1.0r1.0	94.00	3.19	3.19	0.00	0.00	3.19	3.19	4.26	3.30
k2a0.1r0.1	27.00	3.70	1.85	3.70	1.48	7.41	4.07	7.41	4.44
k2a0.1r0.3	28.00	7.14	7.14	7.14	2.86	7.14	6.43	7.14	6.43
k2a0.1r0.5	27.00	3.70	3.70	3.70	2.22	3.70	0.74	3.70	3.70
k2a0.1r0.7	25.00	20.00	20.00	20.00	8.40	16.00	12.80	20.00	20.00
k2a0.1r1.0	23.00	8.70	3.04	13.04	4.78	13.04	9.57	17.39	13.04
k2a0.3r0.1	70.00	1.43	1.43	0.00	0.00	2.86	2.14	2.86	1.57
k2a0.3r0.3	66.00	0.00	0.00	0.00	0.00	3.03	3.03	3.03	2.88
k2a0.3r0.5	60.00	3.33	3.33	1.67	0.50	3.33	3.33	3.33	3.33
k2a0.3r0.7	69.00	1.45	1.45	0.00	0.00	2.90	2.90	1.45	1.45
k2a0.3r1.0	61.00	3.28	3.28	1.64	0.33	4.92	4.92	4.92	3.93
k2a0.5r0.1	98.00	2.04	2.04	1.02	0.10	1.02	1.02	2.04	2.04
k2a0.5r0.3	97.00	1.03	1.03	0.00	0.00	1.03	1.03	1.03	1.03
k2a0.5r0.5	96.00	1.04	1.04	0.00	0.00	1.04	1.04	3.13	2.29
k2a0.5r0.7	91.00	2.20	2.20	0.00	0.00	3.30	2.31	3.30	2.31
k2a0.5r1.0	85.00	1.18	1.18	0.00	0.00	1.18	1.18	1.18	1.18
k2a0.7r0.1	117.00	0.85	0.85	0.00	0.00	0.00	0.00	0.85	0.85
k2a0.7r0.3	114.00	0.88	0.88	0.00	0.00	0.88	0.44	0.88	0.88
k2a0.7r0.5	112.00	0.89	0.89	0.89	0.09	1.79	1.79	1.79	1.79
k2a0.7r0.7	116.00	0.86	0.86	0.00	0.00	1.72	1.72	1.72	1.47
k2a0.7r1.0	111.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.09
k2a1.0r0.1	151.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k2a1.0r0.3	149.00	0.67	0.67	0.00	0.00	0.67	0.67	0.67	0.67
k2a1.0r0.5	152.00	1.32	1.32	0.66	0.07	1.32	0.72	1.32	1.32
k2a1.0r0.7	150.00	0.00	0.00	0.00	0.00	0.67	0.67	0.67	0.13
k2a1.0r1.0	139.00	1.44	1.44	0.00	0.00	1.44	0.86	2.16	2.09
k3a0.1r0.1	38.00	2.63	2.63	5.26	1.84	2.63	2.63	5.26	3.16
k3a0.1r0.3	29.00	13.79	8.97	13.79	8.28	10.34	8.28	10.34	10.34
k3a0.1r0.5	35.00	8.57	5.43	8.57	4.57	8.57	6.00	8.57	6.29
k3a0.1r0.7	37.00	0.00	0.00	0.00	0.00	5.41	3.51	2.70	2.16
k3a0.1r1.0	32.00	12.50	8.44	12.50	5.94	6.25	5.31	12.50	10.63
k3a0.3r0.1	87.00	1.15	1.15	2.30	0.23	3.45	3.10	4.60	3.56
k3a0.3r0.3	90.00	1.11	1.11	0.00	0.00	1.11	1.11	2.22	1.44
k3a0.3r0.5	82.00	1.22	1.22	0.00	0.00	3.66	2.56	3.66	2.56
k3a0.3r0.7	89.00	1.12	1.12	0.00	0.00	1.12	0.79	1.12	1.01
k3a0.3r1.0	84.00	1.19	1.19	0.00	0.00	2.38	2.02	2.38	2.38
k3a0.5r0.1	126.00	0.00	0.00	0.00	0.00	1.59	1.59	1.59	1.51
k3a0.5r0.3	126.00	1.59	1.59	0.00	0.00	2.38	2.38	3.17	2.46

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1 minute	FF	FF- GRASP	FF-ILS	BR-FF	BR-FF-VND				
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k3a0.5r0.5	124.00	0.00	0.00	0.00	0.00	1.61	1.61	1.61	0.97
k3a0.5r0.7	127.00	0.79	0.79	0.00	0.00	0.79	0.47	0.79	0.79
k3a0.5r1.0	117.00	1.71	1.71	0.00	0.00	2.56	1.88	2.56	2.14
k3a0.7r0.1	168.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k3a0.7r0.3	159.00	1.26	1.26	1.26	0.13	1.26	1.26	1.26	1.26
k3a0.7r0.5	155.00	0.65	0.65	0.00	0.00	1.29	1.29	1.29	1.16
k3a0.7r0.7	156.00	1.92	1.92	0.64	0.06	2.56	2.18	2.56	2.50
k3a0.7r1.0	151.00	3.31	3.31	1.32	0.13	3.31	3.05	4.64	3.77
k3a1.0r0.1	193.00	0.52	0.52	0.00	0.00	0.52	0.21	0.52	0.52
k3a1.0r0.3	168.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k3a1.0r0.5	199.00	1.01	1.01	0.00	0.00	1.01	1.01	1.01	1.01
k3a1.0r0.7	190.00	1.05	1.05	0.00	0.00	1.05	1.05	1.58	1.32
k3a1.0r1.0	181.00	1.10	1.10	0.00	0.00	1.66	1.27	1.66	1.16
k5a0.1r0.1	50.00	6.00	4.80	8.00	5.20	2.00	2.00	10.00	6.40
k5a0.1r0.3	48.00	20.83	17.29	20.83	17.29	6.25	4.58	20.83	20.83
k5a0.1r0.5	62.00	11.29	7.58	11.29	5.81	8.06	3.23	11.29	10.16
k5a0.1r0.7	53.00	16.98	10.75	13.21	10.75	1.89	1.89	15.09	11.13
k5a0.1r1.0	50.00	14.00	5.20	10.00	5.20	12.00	11.00	16.00	9.20
k5a0.3r0.1	138.00	0.72	0.72	2.17	0.58	4.35	3.77	3.62	3.19
k5a0.3r0.3	126.00	1.59	1.59	0.00	0.00	2.38	1.75	2.38	2.38
k5a0.3r0.5	122.00	1.64	1.64	1.64	0.33	3.28	3.28	4.10	3.11
k5a0.3r0.7	117.00	0.00	0.00	0.00	0.00	4.27	4.27	4.27	2.39
k5a0.3r1.0	128.00	0.78	0.78	1.56	0.23	2.34	1.72	2.34	1.95
k5a0.5r0.1	188.00	0.53	0.53	0.00	0.00	1.06	0.59	1.06	0.64
k5a0.5r0.3	185.00	0.54	0.54	0.00	0.00	0.54	0.54	0.54	0.54
k5a0.5r0.5	191.00	0.52	0.52	0.00	0.00	1.05	1.05	1.57	1.20
k5a0.5r0.7	180.00	0.56	0.56	0.00	0.00	1.11	1.06	1.11	0.89
k5a0.5r1.0	178.00	0.56	0.56	0.00	0.00	1.12	1.07	1.12	0.96
k5a0.7r0.1	218.00	0.46	0.46	0.00	0.00	0.92	0.87	0.92	0.73
k5a0.7r0.3	228.00	0.00	0.00	0.00	0.00	0.44	0.44	0.44	0.44
k5a0.7r0.5	220.00	0.00	0.00	0.00	0.00	0.45	0.45	0.91	0.73
k5a0.7r0.7	229.00	0.87	0.87	0.00	0.00	1.75	1.48	2.18	2.01
k5a0.7r1.0	225.00	1.33	1.33	0.00	0.00	1.33	1.29	1.78	1.51
k5a1.0r0.1	273.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.15
k5a1.0r0.3	282.00	0.00	0.00	0.00	0.00	1.06	0.43	1.06	0.53
k5a1.0r0.5	281.00	0.00	0.00	0.00	0.00	0.36	0.36	0.36	0.18
k5a1.0r0.7	291.00	0.69	0.69	0.00	0.00	0.69	0.58	1.03	0.72
k5a1.0r1.0	280.00	1.79	1.79	0.00	0.00	1.07	0.89	2.14	1.96
k7a0.1r0.1	78.00	7.69	4.62	10.26	6.41	2.56	2.05	10.26	7.18
k7a0.1r0.3	78.00	15.38	10.26	15.38	9.23	15.38	14.36	17.95	15.38
k7a0.1r0.5	75.00	10.67	4.00	10.67	4.80	6.67	3.47	10.67	4.80
k7a0.1r0.7	70.00	8.57	5.00	5.71	3.29	2.86	2.86	10.00	6.71
k7a0.1r1.0	65.00	12.31	9.54	10.77	8.46	10.77	9.38	12.31	10.46

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1 minute	FF	FF- GRASP		FF-ILS		BR-FF		BR-FF-VND	
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k7a0.3r0.1	159.00	4.40	2.08	3.77	1.01	5.66	4.91	6.29	4.91
k7a0.3r0.3	183.00	1.09	1.09	1.09	0.22	1.64	0.87	1.09	1.09
k7a0.3r0.5	159.00	2.52	1.95	1.89	0.63	3.77	3.27	4.40	3.14
k7a0.3r0.7	165.00	1.21	1.21	1.21	0.30	3.03	3.03	3.03	2.97
k7a0.3r1.0	150.00	2.00	2.00	0.67	0.07	1.33	1.33	2.00	2.00
k7a0.5r0.1	245.00	0.82	0.82	0.00	0.00	0.82	0.82	1.63	0.90
k7a0.5r0.3	256.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k7a0.5r0.5	229.00	0.87	0.87	0.00	0.00	1.31	1.00	2.18	1.48
k7a0.5r0.7	241.00	0.83	0.83	0.00	0.00	1.66	1.33	1.66	1.33
k7a0.5r1.0	255.00	0.00	0.00	0.00	0.00	0.78	0.55	1.18	0.51
k7a0.7r0.1	276.00	2.17	2.17	0.72	0.11	1.09	0.87	2.54	2.25
k7a0.7r0.3	302.00	0.99	0.99	0.99	0.10	1.32	1.03	1.66	1.23
k7a0.7r0.5	306.00	0.33	0.33	0.00	0.00	0.33	0.33	0.65	0.36
k7a0.7r0.7	293.00	2.05	2.05	0.00	0.00	3.07	3.07	3.07	2.42
k7a0.7r1.0	295.00	0.00	0.00	0.00	0.00	1.36	0.98	1.36	0.81
k7a1.0r0.1	393.00	0.51	0.51	0.00	0.00	0.51	0.36	0.51	0.48
k7a1.0r0.3	347.00	1.15	1.15	0.00	0.00	0.86	0.86	1.15	1.15
k7a1.0r0.5	341.00	0.59	0.59	0.00	0.00	0.88	0.88	0.88	0.65
k7a1.0r0.7	348.00	1.44	1.44	0.00	0.00	2.01	1.67	2.01	1.87
k7a1.0r1.0	330.00	0.30	0.30	0.00	0.00	0.00	0.00	0.30	0.30
k10a0.1r0.1	99.00	11.11	7.27	12.12	8.16	6.06	4.14	10.10	9.39
k10a0.1r0.3	93.00	16.13	16.13	16.13	15.77	7.53	4.95	17.20	16.24
k10a0.1r0.5	98.00	23.47	23.47	23.47	19.98	17.35	11.63	23.47	23.06
k10a0.1r0.7	89.00	6.74	6.07	6.74	5.41	3.37	1.35	7.87	6.85
k10a0.1r1.0	86.00	13.95	11.86	13.95	11.31	4.65	4.65	11.63	11.63
k10a0.3r0.1	246.00	1.63	1.26	1.63	0.44	3.66	3.13	3.66	2.89
k10a0.3r0.3	226.00	2.65	0.66	0.88	0.12	1.33	1.02	2.21	1.11
k10a0.3r0.5	217.00	1.84	1.84	1.38	0.34	3.23	2.58	3.23	2.53
k10a0.3r0.7	216.00	0.93	0.93	0.93	0.13	1.39	1.25	1.85	1.20
k10a0.3r1.0	229.00	1.31	1.31	1.75	0.16	3.06	2.10	3.49	2.40
k10a0.5r0.1	362.00	0.55	0.55	0.00	0.00	0.83	0.55	1.10	0.83
k10a0.5r0.3	330.00	0.91	0.91	0.30	0.03	2.12	1.36	1.82	1.45
k10a0.5r0.5	318.00	1.26	1.26	0.00	0.00	1.89	1.70	2.52	1.92
k10a0.5r0.7	314.00	1.27	1.27	0.00	0.00	1.27	1.24	1.59	1.37
k10a0.5r1.0	315.00	0.95	0.95	0.00	0.00	0.63	0.60	0.95	0.83
k10a0.7r0.1	431.00	0.46	0.46	0.00	0.00	0.93	0.63	0.93	0.72
k10a0.7r0.3	440.00	0.00	0.00	0.00	0.00	0.68	0.43	0.45	0.30
k10a0.7r0.5	419.00	0.48	0.48	0.00	0.00	0.95	0.79	1.91	1.15
k10a0.7r0.7	389.00	1.03	1.03	0.00	0.00	1.29	1.08	1.29	1.18
k10a0.7r1.0	410.00	0.73	0.73	0.00	0.00	0.49	0.27	1.71	1.17
k10a1.0r0.1	567.00	0.71	0.71	0.35	0.04	0.71	0.58	1.06	0.90
k10a1.0r0.3	514.00	0.39	0.39	0.19	0.02	0.19	0.19	0.58	0.45
k10a1.0r0.5	473.00	0.21	0.21	0.00	0.00	0.85	0.78	1.06	0.89

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1 minute	FF	FF- GRASP	FF-ILS	BR-FF	BR-FF-VND				
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k10a1.0r0.7	527.00	0.57	0.57	0.00	0.00	0.38	0.34	0.76	0.59
k10a1.0r1.0	467.00	1.07	1.07	0.43	0.04	0.43	0.43	1.07	0.99
Average	163.71	2.75	2.24	2.26	1.33	2.65	2.09	3.53	2.94

Table 1.1: Relative deviations for best solutions (DevBest %) and average of best solutions (AvgDev %) to the FF heuristic for 1 minute stop time criterion

5 minutes	FF	FF- GRASP	FF-ILS	BR-FF	BR-FF-VND				
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k1a0.1r0.1	20	5.00	2.50	5.00	1.50	5.00	3.00	5.00	5.00
k1a0.1r0.3	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.1r0.5	20	5.00	2.50	5.00	5.00	5.00	5.00	5.00	5.00
k1a0.1r0.7	14	21.43	20.71	21.43	21.43	28.57	19.29	21.43	21.43
k1a0.1r1.0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.1	45	0.00	0.00	0.00	0.00	2.22	2.22	2.22	2.22
k1a0.3r0.3	45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.5	46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.7	46	0.00	0.00	2.17	2.17	2.17	2.17	2.17	2.17
k1a0.3r1.0	43	0.00	0.00	0.00	0.00	4.65	2.79	2.33	2.33
k1a0.5r0.1	65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.5r0.3	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.5r0.5	67	0.00	0.00	0.00	0.00	0.00	0.00	1.49	0.30
k1a0.5r0.7	65	0.00	0.00	0.00	0.00	1.54	1.54	1.54	0.77
k1a0.5r1.0	59	0.00	0.00	0.00	0.00	1.69	1.69	1.69	1.69
k1a0.7r0.1	80	0.00	0.00	0.00	0.00	1.25	1.00	1.25	1.00
k1a0.7r0.3	80	1.25	0.12	1.25	1.25	1.25	1.25	1.25	1.25
k1a0.7r0.5	80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.7r0.7	79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.7r1.0	78	0.00	0.00	1.28	1.28	1.28	1.28	1.28	1.28
k1a1.0r0.1	99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a1.0r0.3	98	1.02	1.02	1.02	1.02	0.00	0.00	1.02	1.02
k1a1.0r0.5	98	0.00	0.00	1.02	1.02	1.02	1.02	1.02	1.02
k1a1.0r0.7	97	0.00	0.00	1.03	1.03	0.00	0.00	1.03	1.03
k1a1.0r1.0	94	1.06	0.11	3.19	3.19	3.19	3.19	4.26	3.30
k2a0.1r0.1	27	3.70	3.70	7.41	4.44	7.41	5.93	7.41	7.41
k2a0.1r0.3	28	7.14	5.00	7.14	7.14	7.14	7.14	7.14	7.14
k2a0.1r0.5	27	3.70	3.70	3.70	3.70	3.70	2.22	3.70	3.70
k2a0.1r0.7	25	20.00	13.60	20.00	20.00	16.00	14.40	20.00	20.00
k2a0.1r1.0	23	13.04	8.70	13.04	8.70	13.04	12.61	17.39	17.39

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5 minutes	FF	FF- GRASP		FF-ILS		BR-FF		BR-FF-VND	
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k2a0.3r0.1	70	2.86	0.57	2.86	1.57	2.86	2.86	2.86	2.00
k2a0.3r0.3	66	1.52	0.30	1.52	0.30	3.03	3.03	3.03	3.03
k2a0.3r0.5	60	1.67	1.00	3.33	3.33	3.33	3.33	3.33	3.33
k2a0.3r0.7	69	0.00	0.00	1.45	1.45	2.90	2.90	4.35	2.90
k2a0.3r1.0	61	1.64	0.82	3.28	3.28	4.92	4.92	6.56	5.08
k2a0.5r0.1	98	1.02	0.31	2.04	2.04	2.04	1.33	2.04	2.04
k2a0.5r0.3	97	0.00	0.00	1.03	1.03	1.03	1.03	1.03	1.03
k2a0.5r0.5	96	1.04	0.21	1.04	1.04	2.08	1.25	3.13	2.81
k2a0.5r0.7	91	1.10	0.11	2.20	2.20	3.30	2.75	3.30	3.08
k2a0.5r1.0	85	0.00	0.00	1.18	1.18	1.18	1.18	2.35	1.41
k2a0.7r0.1	117	0.00	0.00	0.85	0.85	0.00	0.00	0.85	0.85
k2a0.7r0.3	114	0.00	0.00	0.88	0.88	0.88	0.70	0.88	0.88
k2a0.7r0.5	112	0.89	0.09	0.89	0.89	1.79	1.79	1.79	1.79
k2a0.7r0.7	116	0.00	0.00	0.86	0.86	1.72	1.72	1.72	1.72
k2a0.7r1.0	111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k2a1.0r0.1	151	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k2a1.0r0.3	149	0.67	0.07	0.67	0.67	0.67	0.67	0.67	0.67
k2a1.0r0.5	152	0.66	0.07	1.32	1.32	1.32	0.99	1.32	1.32
k2a1.0r0.7	150	0.00	0.00	0.00	0.00	0.67	0.67	0.67	0.47
k2a1.0r1.0	139	0.00	0.00	1.44	1.44	1.44	1.37	2.16	2.16
k3a0.1r0.1	38	5.26	3.42	5.26	2.89	2.63	2.63	5.26	4.74
k3a0.1r0.3	29	13.79	10.69	17.24	12.41	10.34	10.34	17.24	11.72
k3a0.1r0.5	35	8.57	7.14	8.57	6.57	8.57	7.43	8.57	8.29
k3a0.1r0.7	37	2.70	1.08	2.70	0.81	5.41	4.86	5.41	3.24
k3a0.1r1.0	32	12.50	10.31	15.63	10.63	6.25	6.25	15.63	12.81
k3a0.3r0.1	87	3.45	1.72	3.45	1.95	3.45	3.45	4.60	4.37
k3a0.3r0.3	90	0.00	0.00	1.11	1.11	2.22	1.56	2.22	1.56
k3a0.3r0.5	82	1.22	0.24	1.22	1.22	4.88	2.93	3.66	3.41
k3a0.3r0.7	89	1.12	0.11	1.12	1.12	1.12	1.12	1.12	1.12
k3a0.3r1.0	84	1.19	0.12	1.19	1.19	2.38	2.38	3.57	3.10
k3a0.5r0.1	126	0.79	0.08	0.00	0.00	1.59	1.59	1.59	1.59
k3a0.5r0.3	126	0.79	0.08	1.59	1.59	3.17	2.62	3.17	2.70
k3a0.5r0.5	124	0.00	0.00	0.00	0.00	1.61	1.61	1.61	1.53
k3a0.5r0.7	127	0.00	0.00	0.79	0.79	0.79	0.79	0.79	0.79
k3a0.5r1.0	117	0.00	0.00	1.71	1.71	2.56	2.31	2.56	2.56
k3a0.7r0.1	168	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k3a0.7r0.3	159	1.26	0.13	1.26	1.26	1.26	1.26	1.89	1.38
k3a0.7r0.5	155	0.00	0.00	0.65	0.65	1.29	1.29	1.29	1.29
k3a0.7r0.7	156	0.64	0.06	1.92	1.92	2.56	2.50	2.56	2.56
k3a0.7r1.0	151	1.32	0.40	3.31	3.31	4.64	3.44	4.64	4.24
k3a1.0r0.1	193	0.00	0.00	0.52	0.52	0.52	0.47	0.52	0.52
k3a1.0r0.3	168	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k3a1.0r0.5	199	0.50	0.06	1.01	1.01	1.01	1.01	1.51	1.06

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5 minutes	FF	FF- GRASP		FF-ILS		BR-FF		BR-FF-VND	
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k3a1.0r0.7	190	0.00	0.00	1.05	1.05	1.05	1.05	1.58	1.53
k3a1.0r1.0	181	0.00	0.00	1.10	1.10	1.66	1.66	1.66	1.38
k5a0.1r0.1	50	8.00	6.89	8.00	6.20	2.00	2.00	10.00	7.80
k5a0.1r0.3	48	20.83	18.29	20.83	19.38	6.25	4.58	22.92	21.04
k5a0.1r0.5	62	11.29	8.78	14.52	9.68	8.06	3.87	12.90	11.13
k5a0.1r0.7	53	16.98	13.42	20.75	15.28	3.77	2.45	16.98	13.96
k5a0.1r1.0	50	12.00	10.44	18.00	12.80	12.00	12.00	16.00	11.60
k5a0.3r0.1	138	2.17	1.05	2.90	1.09	4.35	3.99	3.62	3.62
k5a0.3r0.3	126	0.79	0.35	1.59	1.59	2.38	2.30	3.17	2.54
k5a0.3r0.5	122	1.64	0.73	1.64	1.64	4.10	3.44	4.10	3.28
k5a0.3r0.7	117	0.85	0.09	0.85	0.09	4.27	4.27	5.13	3.85
k5a0.3r1.0	128	1.56	0.69	0.78	0.78	3.13	2.34	2.34	2.27
k5a0.5r0.1	188	0.00	0.00	0.53	0.53	1.06	0.69	1.06	0.96
k5a0.5r0.3	185	0.00	0.00	0.54	0.54	0.54	0.54	0.54	0.54
k5a0.5r0.5	191	0.00	0.00	0.52	0.52	1.57	1.31	1.57	1.41
k5a0.5r0.7	180	0.00	0.00	0.56	0.56	1.11	1.11	1.11	1.11
k5a0.5r1.0	178	0.00	0.00	0.56	0.56	1.12	1.12	1.69	1.24
k5a0.7r0.1	218	0.00	0.00	0.46	0.46	0.92	0.92	0.92	0.92
k5a0.7r0.3	228	0.00	0.00	0.00	0.00	0.44	0.44	0.44	0.44
k5a0.7r0.5	220	0.00	0.00	0.00	0.00	0.45	0.45	0.91	0.91
k5a0.7r0.7	229	0.44	0.05	0.87	0.87	1.75	1.75	2.18	2.14
k5a0.7r1.0	225	0.00	0.00	1.33	1.33	1.78	1.42	1.78	1.73
k5a1.0r0.1	273	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.37
k5a1.0r0.3	282	0.00	0.00	0.00	0.00	1.06	0.96	1.06	1.06
k5a1.0r0.5	281	0.00	0.00	0.00	0.00	0.36	0.36	0.36	0.36
k5a1.0r0.7	291	0.00	0.00	0.69	0.69	1.03	0.72	1.03	0.76
k5a1.0r1.0	280	0.00	0.00	1.79	1.79	1.07	1.04	2.14	2.14
k7a0.1r0.1	78	10.26	7.21	10.26	6.79	2.56	2.56	10.26	8.46
k7a0.1r0.3	78	17.95	15.22	20.51	16.67	15.38	15.13	17.95	17.05
k7a0.1r0.5	75	10.67	6.50	10.67	8.00	6.67	4.93	10.67	6.67
k7a0.1r0.7	70	5.71	4.46	10.00	6.00	2.86	2.86	10.00	7.57
k7a0.1r1.0	65	10.77	9.81	12.31	10.77	10.77	9.54	12.31	11.85
k7a0.3r0.1	159	6.29	3.85	5.66	3.52	6.29	5.85	7.55	6.10
k7a0.3r0.3	183	1.09	0.48	1.09	1.09	1.64	1.42	2.19	1.75
k7a0.3r0.5	159	1.89	1.18	2.52	1.95	3.77	3.71	4.40	3.96
k7a0.3r0.7	165	1.21	0.68	1.21	1.21	3.03	3.03	3.64	3.09
k7a0.3r1.0	150	0.67	0.33	2.00	2.00	2.00	1.47	3.33	2.60
k7a0.5r0.1	245	0.41	0.05	0.82	0.82	0.82	0.82	1.63	1.06
k7a0.5r0.3	256	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k7a0.5r0.5	229	0.00	0.00	0.87	0.87	1.31	1.31	2.18	1.66
k7a0.5r0.7	241	0.41	0.10	0.83	0.83	2.07	1.62	1.66	1.58
k7a0.5r1.0	255	0.00	0.00	0.00	0.00	0.78	0.75	1.18	0.71
k7a0.7r0.1	276	0.72	0.18	2.17	2.17	1.45	1.12	2.54	2.46

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5 minutes	FF	FF- GRASP		FF-ILS		BR-FF		BR-FF-VND	
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k7a0.7r0.3	302	0.99	0.12	0.99	0.99	1.32	1.16	1.99	1.56
k7a0.7r0.5	306	0.00	0.00	0.33	0.33	0.33	0.33	0.65	0.42
k7a0.7r0.7	293	0.00	0.00	2.05	2.05	3.41	3.14	3.41	2.80
k7a0.7r1.0	295	0.00	0.00	0.00	0.00	1.36	1.22	1.36	1.08
k7a1.0r0.1	393	0.00	0.00	0.51	0.51	0.51	0.51	0.51	0.51
k7a1.0r0.3	347	0.00	0.00	1.15	1.15	1.15	1.04	1.15	1.15
k7a1.0r0.5	341	0.00	0.00	0.59	0.59	0.88	0.88	0.88	0.79
k7a1.0r0.7	348	0.86	0.25	1.72	1.47	2.01	1.81	2.01	1.95
k7a1.0r1.0	330	0.00	0.00	0.30	0.30	0.30	0.09	0.30	0.30
k10a0.1r0.1	99	12.12	11.01	12.12	9.90	8.08	5.15	11.11	10.00
k10a0.1r0.3	93	18.28	16.67	17.20	16.34	7.53	6.13	20.43	16.67
k10a0.1r0.5	98	23.47	22.76	23.47	23.47	17.35	16.53	23.47	23.47
k10a0.1r0.7	89	6.74	6.40	6.74	6.52	3.37	1.35	8.99	7.64
k10a0.1r1.0	86	15.12	12.91	15.12	12.91	4.65	4.65	15.12	12.33
k10a0.3r0.1	246	3.66	1.83	2.85	1.79	3.66	3.54	4.07	3.46
k10a0.3r0.3	226	1.77	0.58	3.10	0.80	1.77	1.42	3.98	3.10
k10a0.3r0.5	217	1.84	0.92	2.76	2.03	4.61	3.55	3.23	2.81
k10a0.3r0.7	216	0.93	0.23	0.93	0.93	1.85	1.48	2.31	1.67
k10a0.3r1.0	229	2.62	1.00	2.18	1.48	3.06	2.79	4.37	3.23
k10a0.5r0.1	362	0.00	0.00	0.55	0.55	0.83	0.64	1.38	1.02
k10a0.5r0.3	330	1.52	0.39	0.91	0.91	2.42	1.64	2.42	2.06
k10a0.5r0.5	318	1.26	0.19	1.26	1.26	2.20	1.92	2.52	2.20
k10a0.5r0.7	314	0.64	0.10	1.27	1.27	1.27	1.27	1.91	1.69
k10a0.5r1.0	315	0.00	0.00	0.95	0.95	0.95	0.70	1.27	0.95
k10a0.7r0.1	431	0.00	0.00	0.46	0.46	0.93	0.81	1.16	0.86
k10a0.7r0.3	440	0.00	0.00	0.00	0.00	0.68	0.64	0.91	0.64
k10a0.7r0.5	419	0.00	0.00	0.48	0.48	1.19	1.00	1.91	1.22
k10a0.7r0.7	389	0.00	0.00	1.03	1.03	1.29	1.26	1.80	1.39
k10a0.7r1.0	410	0.49	0.05	0.73	0.73	1.22	0.49	1.71	1.39
k10a1.0r0.1	567	0.35	0.04	0.71	0.71	0.71	0.71	1.06	1.01
k10a1.0r0.3	514	0.19	0.02	0.39	0.39	0.19	0.19	0.58	0.58
k10a1.0r0.5	473	0.42	0.13	0.42	0.23	1.06	0.95	1.48	1.16
k10a1.0r0.7	527	0.00	0.00	0.57	0.57	0.57	0.42	0.95	0.74
k10a1.0r1.0	467	0.86	0.13	1.07	1.07	0.64	0.58	1.28	1.09
Average	163.71	2.60	1.92	3.18	2.64	2.81	2.43	3.88	3.38

Table 1.2: Relative deviations for best solutions (DevBest %) and average of best solutions (AvgDev %) to the FF heuristic for 5 minutes stop time criterion

10 minutes	FF	FF- GRASP		FF-ILS		BR-FF		BR-FF-VND	
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k1a0.1r0.1	20	5.00	3.50	5.00	2.00	5.00	4.50	5.00	5.00
k1a0.1r0.3	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.1r0.5	20	5.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00
k1a0.1r0.7	14	21.43	21.43	28.57	23.57	28.57	22.86	21.43	21.43
k1a0.1r1.0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.1	45	0.00	0.00	0.00	0.00	2.22	2.22	2.22	2.22
k1a0.3r0.3	45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.5	46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.7	46	0.00	0.00	2.17	2.17	2.17	2.17	2.17	2.17
k1a0.3r1.0	43	0.00	0.00	0.00	0.00	4.65	3.72	4.65	2.79
k1a0.5r0.1	65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.5r0.3	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.5r0.5	67	0.00	0.00	0.00	0.00	0.00	0.00	1.49	0.60
k1a0.5r0.7	65	0.00	0.00	0.00	0.00	1.54	1.54	1.54	1.23
k1a0.5r1.0	59	0.00	0.00	0.00	0.00	1.69	1.69	1.69	1.69
k1a0.7r0.1	80	0.00	0.00	0.00	0.00	1.25	1.25	1.25	1.13
k1a0.7r0.3	80	1.25	0.37	1.25	1.25	1.25	1.25	1.25	1.25
k1a0.7r0.5	80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.7r0.7	79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.7r1.0	78	0.00	0.00	1.28	1.28	1.28	1.28	1.28	1.28
k1a1.0r0.1	99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a1.0r0.3	98	1.02	1.02	1.02	1.02	0.00	0.00	1.02	1.02
k1a1.0r0.5	98	0.00	0.00	1.02	1.02	1.02	1.02	1.02	1.02
k1a1.0r0.7	97	0.00	0.00	1.03	1.03	0.00	0.00	1.03	1.03
k1a1.0r1.0	94	1.06	0.11	3.19	3.19	3.19	3.19	4.26	3.83
k2a0.1r0.1	27	7.41	4.81	7.41	6.30	7.41	6.67	7.41	7.41
k2a0.1r0.3	28	7.14	6.07	7.14	7.14	7.14	7.14	7.14	7.14
k2a0.1r0.5	27	3.70	3.70	3.70	3.70	3.70	3.70	7.41	4.44
k2a0.1r0.7	25	20.00	14.40	20.00	20.00	16.00	15.60	20.00	20.00
k2a0.1r1.0	23	13.04	9.13	13.04	10.00	13.04	13.04	17.39	17.39
k2a0.3r0.1	70	2.86	0.71	2.86	1.57	2.86	2.86	2.86	2.00
k2a0.3r0.3	66	1.52	0.76	1.52	0.76	3.03	3.03	3.03	3.03
k2a0.3r0.5	60	3.33	1.50	3.33	3.33	3.33	3.33	3.33	3.33
k2a0.3r0.7	69	0.00	0.00	1.45	1.45	2.90	2.90	4.35	3.19
k2a0.3r1.0	61	3.28	1.31	3.28	3.28	4.92	4.92	6.56	5.08
k2a0.5r0.1	98	1.02	0.71	2.04	2.04	2.04	1.43	2.04	2.04
k2a0.5r0.3	97	0.00	0.00	1.03	1.03	1.03	1.03	1.03	1.03
k2a0.5r0.5	96	1.04	0.62	1.04	1.04	2.08	1.35	3.13	2.92
k2a0.5r0.7	91	1.10	0.11	2.20	2.20	3.30	2.97	3.30	3.19
k2a0.5r1.0	85	0.00	0.00	1.18	1.18	2.35	1.29	2.35	1.65
k2a0.7r0.1	117	0.00	0.00	0.85	0.85	0.85	0.09	0.85	0.85
k2a0.7r0.3	114	0.00	0.00	0.88	0.88	0.88	0.88	0.88	0.88

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10 minutes	FF	FF- GRASP		FF-ILS		BR-FF		BR-FF-VND	
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k2a0.7r0.5	112	0.89	0.09	0.89	0.89	1.79	1.79	1.79	1.79
k2a0.7r0.7	116	0.86	0.09	0.86	0.86	1.72	1.72	1.72	1.72
k2a0.7r1.0	111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k2a1.0r0.1	151	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k2a1.0r0.3	149	0.67	0.20	0.67	0.67	0.67	0.67	0.67	0.67
k2a1.0r0.5	152	0.66	0.07	1.32	1.32	1.32	1.25	1.32	1.32
k2a1.0r0.7	150	0.00	0.00	0.00	0.00	0.67	0.67	0.67	0.67
k2a1.0r1.0	139	0.00	0.00	1.44	1.44	1.44	1.37	2.16	2.16
k3a0.1r0.1	38	5.26	3.68	5.26	3.68	2.63	2.63	5.26	5.26
k3a0.1r0.3	29	13.79	11.03	17.24	13.79	10.34	10.34	17.24	12.07
k3a0.1r0.5	35	8.57	7.14	8.57	7.43	8.57	7.71	8.57	8.57
k3a0.1r0.7	37	5.41	1.89	5.41	2.43	5.41	5.41	5.41	3.51
k3a0.1r1.0	32	15.63	12.19	15.63	11.56	12.50	6.88	15.63	13.13
k3a0.3r0.1	87	3.45	2.64	3.45	2.18	3.45	3.45	4.60	4.48
k3a0.3r0.3	90	1.11	0.11	1.11	1.11	2.22	1.78	2.22	1.67
k3a0.3r0.5	82	1.22	0.49	1.22	1.22	4.88	3.17	3.66	3.66
k3a0.3r0.7	89	1.12	0.22	1.12	1.12	2.25	1.35	1.12	1.12
k3a0.3r1.0	84	1.19	0.36	1.19	1.19	3.57	2.50	3.57	3.57
k3a0.5r0.1	126	0.79	0.24	0.79	0.16	1.59	1.59	1.59	1.59
k3a0.5r0.3	126	0.79	0.08	1.59	1.59	3.17	3.02	3.17	2.94
k3a0.5r0.5	124	0.00	0.00	0.00	0.00	1.61	1.61	1.61	1.61
k3a0.5r0.7	127	0.00	0.00	0.79	0.79	0.79	0.79	0.79	0.79
k3a0.5r1.0	117	0.00	0.00	1.71	1.71	2.56	2.56	2.56	2.56
k3a0.7r0.1	168	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k3a0.7r0.3	159	1.26	0.31	1.26	1.26	1.26	1.26	1.89	1.45
k3a0.7r0.5	155	0.00	0.00	0.65	0.65	1.29	1.29	1.29	1.29
k3a0.7r0.7	156	0.64	0.13	1.92	1.92	2.56	2.56	2.56	2.56
k3a0.7r1.0	151	2.65	0.60	3.31	3.31	4.64	3.51	4.64	4.44
k3a1.0r0.1	193	0.00	0.00	0.52	0.52	0.52	0.52	0.52	0.52
k3a1.0r0.3	168	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k3a1.0r0.5	199	0.50	0.05	1.01	1.01	1.01	1.01	1.51	1.21
k3a1.0r0.7	190	0.00	0.00	1.05	1.05	1.05	1.05	1.58	1.58
k3a1.0r1.0	181	0.00	0.00	1.10	1.10	1.66	1.66	1.66	1.55
k5a0.1r0.1	50	8.00	7.40	8.00	6.40	2.00	2.00	10.00	8.40
k5a0.1r0.3	48	20.83	19.38	22.92	21.25	6.25	5.00	22.92	21.04
k5a0.1r0.5	62	11.29	10.16	14.52	11.13	8.06	4.84	12.90	11.29
k5a0.1r0.7	53	16.98	13.77	20.75	16.60	3.77	2.83	18.87	15.47
k5a0.1r1.0	50	12.00	10.60	20.00	15.40	12.00	12.00	16.00	12.20
k5a0.3r0.1	138	2.17	1.38	2.90	1.23	4.35	4.13	4.35	3.84
k5a0.3r0.3	126	2.38	1.11	1.59	1.59	2.38	2.38	3.17	2.62
k5a0.3r0.5	122	1.64	0.98	1.64	1.64	4.10	3.44	4.10	3.36
k5a0.3r0.7	117	0.85	0.17	2.56	0.43	4.27	4.27	5.13	4.36
k5a0.3r1.0	128	2.34	0.86	1.56	0.86	3.13	2.34	2.34	2.34

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10 minutes	FF	FF- GRASP		FF-ILS		BR-FF		BR-FF-VND	
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k5a0.5r0.1	188	0.53	0.05	0.53	0.53	1.06	0.85	1.06	1.01
k5a0.5r0.3	185	0.00	0.00	0.54	0.54	0.54	0.54	0.54	0.54
k5a0.5r0.5	191	0.52	0.05	0.52	0.52	1.57	1.52	1.57	1.47
k5a0.5r0.7	180	0.00	0.00	0.56	0.56	1.11	1.11	1.11	1.11
k5a0.5r1.0	178	0.00	0.00	0.56	0.56	1.12	1.12	1.69	1.40
k5a0.7r0.1	218	0.00	0.00	0.46	0.46	0.92	0.92	0.92	0.92
k5a0.7r0.3	228	0.00	0.00	0.00	0.00	0.44	0.44	0.44	0.44
k5a0.7r0.5	220	0.00	0.00	0.00	0.00	0.91	0.55	0.91	0.91
k5a0.7r0.7	229	0.87	0.13	0.87	0.87	2.18	1.79	2.18	2.18
k5a0.7r1.0	225	0.00	0.00	1.33	1.33	1.78	1.56	1.78	1.78
k5a1.0r0.1	273	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.37
k5a1.0r0.3	282	0.71	0.07	0.71	0.07	1.06	1.06	1.06	1.06
k5a1.0r0.5	281	0.00	0.00	0.00	0.00	0.36	0.36	0.36	0.36
k5a1.0r0.7	291	0.00	0.00	0.69	0.69	1.03	0.76	1.03	0.79
k5a1.0r1.0	280	0.00	0.00	1.79	1.79	1.07	1.07	2.14	2.14
k7a0.1r0.1	78	10.26	7.95	11.54	8.21	2.56	2.56	10.26	8.97
k7a0.1r0.3	78	17.95	16.67	20.51	18.59	15.38	15.38	20.51	17.69
k7a0.1r0.5	75	10.67	6.93	10.67	9.07	6.67	6.00	10.67	8.93
k7a0.1r0.7	70	7.14	5.57	10.00	7.43	2.86	2.86	10.00	8.86
k7a0.1r1.0	65	10.77	10.15	12.31	11.23	10.77	9.69	12.31	12.31
k7a0.3r0.1	159	6.29	4.09	6.29	4.15	6.29	5.97	7.55	6.42
k7a0.3r0.3	183	1.09	0.60	1.09	1.09	1.64	1.58	2.19	1.86
k7a0.3r0.5	159	3.14	1.45	3.14	2.08	3.77	3.77	4.40	3.96
k7a0.3r0.7	165	1.82	1.09	2.42	1.33	3.03	3.03	3.64	3.21
k7a0.3r1.0	150	2.00	0.67	2.00	2.00	2.00	1.73	3.33	2.87
k7a0.5r0.1	245	0.41	0.08	0.82	0.82	0.82	0.82	1.63	1.18
k7a0.5r0.3	256	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k7a0.5r0.5	229	1.31	0.13	0.87	0.87	1.31	1.31	2.18	1.88
k7a0.5r0.7	241	0.41	0.08	0.83	0.83	2.07	1.74	1.66	1.62
k7a0.5r1.0	255	0.00	0.00	0.00	0.00	0.78	0.78	1.18	0.94
k7a0.7r0.1	276	1.09	0.29	2.17	2.17	1.45	1.23	2.54	2.50
k7a0.7r0.3	302	0.99	0.20	0.99	0.99	1.32	1.26	2.32	1.69
k7a0.7r0.5	306	0.00	0.00	0.33	0.33	0.33	0.33	0.65	0.56
k7a0.7r0.7	293	1.02	0.10	2.05	2.05	3.41	3.14	3.41	2.83
k7a0.7r1.0	295	0.00	0.00	0.00	0.00	1.36	1.32	1.69	1.29
k7a1.0r0.1	393	0.00	0.00	0.51	0.51	0.51	0.51	0.76	0.53
k7a1.0r0.3	347	0.86	0.12	1.15	1.15	1.15	1.04	1.15	1.15
k7a1.0r0.5	341	0.29	0.03	0.59	0.59	0.88	0.88	0.88	0.88
k7a1.0r0.7	348	1.44	0.34	1.72	1.47	2.01	1.93	2.01	2.01
k7a1.0r1.0	330	0.00	0.00	0.30	0.30	0.30	0.09	0.30	0.30
k10a0.1r0.1	99	12.12	11.21	12.12	11.11	8.08	5.56	11.11	10.30
k10a0.1r0.3	93	18.28	17.10	18.28	16.88	8.60	7.10	20.43	17.20
k10a0.1r0.5	98	23.47	23.16	23.47	23.47	18.37	17.35	23.47	23.47

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10 minutes	FF	FF- GRASP	FF-ILS	BR-FF	BR-FF-VND				
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k10a0.1r0.7	89	6.74	6.52	7.87	6.74	7.87	2.25	8.99	7.75
k10a0.1r1.0	86	15.12	12.91	15.12	13.26	6.98	4.88	15.12	12.79
k10a0.3r0.1	246	3.66	2.11	3.25	2.15	4.07	3.66	4.07	3.58
k10a0.3r0.3	226	3.10	0.80	3.10	0.97	1.77	1.42	4.42	3.23
k10a0.3r0.5	217	1.84	1.24	2.76	2.03	4.61	3.55	3.23	3.09
k10a0.3r0.7	216	1.39	0.51	0.93	0.93	1.85	1.67	2.78	1.85
k10a0.3r1.0	229	2.62	1.35	3.06	1.70	3.06	2.88	4.37	3.45
k10a0.5r0.1	362	0.00	0.00	0.55	0.55	0.83	0.69	1.38	1.13
k10a0.5r0.3	330	1.52	0.55	1.21	0.94	2.42	1.94	2.73	2.15
k10a0.5r0.5	318	1.26	0.38	1.26	1.26	2.20	1.95	2.83	2.30
k10a0.5r0.7	314	0.64	0.13	1.27	1.27	1.27	1.27	1.91	1.75
k10a0.5r1.0	315	0.00	0.00	0.95	0.95	0.95	0.73	1.27	0.98
k10a0.7r0.1	431	0.00	0.00	0.46	0.46	0.93	0.86	1.39	1.00
k10a0.7r0.3	440	0.00	0.00	0.00	0.00	0.68	0.64	0.91	0.77
k10a0.7r0.5	419	0.00	0.00	0.48	0.48	1.19	1.05	1.91	1.36
k10a0.7r0.7	389	0.00	0.00	1.03	1.03	1.29	1.29	1.80	1.52
k10a0.7r1.0	410	0.49	0.10	0.73	0.73	1.22	0.66	1.71	1.56
k10a1.0r0.1	567	0.53	0.16	0.71	0.71	0.71	0.71	1.06	1.02
k10a1.0r0.3	514	0.19	0.02	0.39	0.39	0.19	0.19	0.58	0.58
k10a1.0r0.5	473	0.42	0.13	0.42	0.23	1.06	0.97	1.48	1.16
k10a1.0r0.7	527	0.00	0.00	0.57	0.57	0.57	0.49	0.95	0.82
k10a1.0r1.0	467	0.86	0.13	1.07	1.07	0.64	0.62	1.28	1.16
Average	163.71	2.81	2.11	3.35	2.84	2.95	2.59	3.97	3.53

Table 1.3: Relative deviations for best solutions (DevBest %) and average of best solutions (AvgDev %) to the FF heuristic for 10 minutes stop time criterion

30 minutes	FF	FF- GRASP	FF-ILS	BR-FF	BR-FF-VND				
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k1a0.1r0.1	20	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
k1a0.1r0.3	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.1r0.5	20	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
k1a0.1r0.7	14	21.43	21.43	28.57	25.71	28.57	25.00	28.57	22.14
k1a0.1r1.0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.1	45	0.00	0.00	0.00	0.00	2.22	2.22	2.22	2.22
k1a0.3r0.3	45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.5	46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.7	46	0.00	0.00	2.17	2.17	2.17	2.17	2.17	2.17
k1a0.3r1.0	43	0.00	0.00	0.00	0.00	4.65	3.95	4.65	3.26

Continue on the next page

30 minutes	FF	FF- GRASP		FF-ILS		BR-FF		BR-FF-VND	
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k1a0.5r0.1	65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.5r0.3	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.5r0.5	67	0.00	0.00	0.00	0.00	0.00	0.00	1.49	0.90
k1a0.5r0.7	65	0.00	0.00	0.00	0.00	1.54	1.54	1.54	1.54
k1a0.5r1.0	59	0.00	0.00	0.00	0.00	1.69	1.69	1.69	1.69
k1a0.7r0.1	80	1.25	0.12	0.00	0.00	1.25	1.25	1.25	1.25
k1a0.7r0.3	80	1.25	0.88	1.25	1.25	1.25	1.25	1.25	1.25
k1a0.7r0.5	80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.7r0.7	79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.7r1.0	78	0.00	0.00	1.28	1.28	1.28	1.28	1.28	1.28
k1a1.0r0.1	99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a1.0r0.3	98	1.02	1.02	1.02	1.02	0.00	0.00	1.02	1.02
k1a1.0r0.5	98	1.02	0.10	1.02	1.02	1.02	1.02	1.02	1.02
k1a1.0r0.7	97	0.00	0.00	1.03	1.03	0.00	0.00	1.03	1.03
k1a1.0r1.0	94	1.06	0.11	3.19	3.19	3.19	3.19	4.26	4.26
k2a0.1r0.1	27	7.41	6.30	7.41	7.04	7.41	7.41	7.41	7.41
k2a0.1r0.3	28	7.14	7.14	7.14	7.14	7.14	7.14	7.14	7.14
k2a0.1r0.5	27	3.70	3.70	3.70	3.70	3.70	3.70	7.41	5.56
k2a0.1r0.7	25	20.00	18.80	20.00	20.00	20.00	16.80	20.00	20.00
k2a0.1r1.0	23	13.04	12.17	13.04	11.74	13.04	13.04	17.39	17.39
k2a0.3r0.1	70	2.86	1.43	2.86	1.86	2.86	2.86	2.86	2.71
k2a0.3r0.3	66	1.52	0.91	3.03	1.06	3.03	3.03	3.03	3.03
k2a0.3r0.5	60	3.33	2.00	3.33	3.33	3.33	3.33	3.33	3.33
k2a0.3r0.7	69	1.45	0.43	1.45	1.45	4.35	3.04	4.35	3.33
k2a0.3r1.0	61	3.28	2.13	3.28	3.28	6.56	5.41	6.56	5.90
k2a0.5r0.1	98	2.04	1.12	2.04	2.04	2.04	2.04	2.04	2.04
k2a0.5r0.3	97	0.00	0.00	1.03	1.03	1.03	1.03	1.03	1.03
k2a0.5r0.5	96	1.04	0.73	1.04	1.04	2.08	1.67	3.13	3.13
k2a0.5r0.7	91	1.10	0.44	2.20	2.20	3.30	3.30	3.30	3.30
k2a0.5r1.0	85	0.00	0.00	1.18	1.18	2.35	1.41	2.35	1.65
k2a0.7r0.1	117	0.00	0.00	0.85	0.85	0.85	0.43	0.85	0.85
k2a0.7r0.3	114	0.00	0.00	0.88	0.88	0.88	0.88	0.88	0.88
k2a0.7r0.5	112	0.89	0.27	0.89	0.89	1.79	1.79	1.79	1.79
k2a0.7r0.7	116	0.86	0.09	0.86	0.86	1.72	1.72	1.72	1.72
k2a0.7r1.0	111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k2a1.0r0.1	151	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k2a1.0r0.3	149	0.67	0.40	0.67	0.67	0.67	0.67	0.67	0.67
k2a1.0r0.5	152	1.32	0.39	1.32	1.32	1.32	1.32	1.32	1.32
k2a1.0r0.7	150	0.00	0.00	0.00	0.00	0.67	0.67	0.67	0.67
k2a1.0r1.0	139	0.00	0.00	1.44	1.44	1.44	1.44	2.16	2.16
k3a0.1r0.1	38	5.26	4.74	5.26	4.47	2.63	2.63	5.26	5.26
k3a0.1r0.3	29	17.24	13.10	17.24	15.52	10.34	10.34	17.24	12.07
k3a0.1r0.5	35	8.57	8.00	8.57	7.71	8.57	8.57	8.57	8.57

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30 minutes	FF	FF- GRASP		FF-ILS		BR-FF		BR-FF-VND	
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k3a0.1r0.7	37	5.41	4.05	5.41	4.86	5.41	5.41	8.11	6.22
k3a0.1r1.0	32	15.63	13.13	15.63	14.06	12.50	8.13	15.63	13.13
k3a0.3r0.1	87	3.45	3.22	3.45	2.53	3.45	3.45	4.60	4.60
k3a0.3r0.3	90	1.11	0.44	1.11	1.11	2.22	2.00	2.22	1.89
k3a0.3r0.5	82	2.44	1.22	2.44	1.46	4.88	3.66	3.66	3.66
k3a0.3r0.7	89	1.12	0.56	1.12	1.12	2.25	1.57	1.12	1.12
k3a0.3r1.0	84	1.19	0.60	1.19	1.19	3.57	3.33	3.57	3.57
k3a0.5r0.1	126	0.79	0.32	0.79	0.32	1.59	1.59	1.59	1.59
k3a0.5r0.3	126	0.79	0.63	1.59	1.59	3.17	3.17	3.17	3.17
k3a0.5r0.5	124	0.00	0.00	0.00	0.00	1.61	1.61	1.61	1.61
k3a0.5r0.7	127	0.00	0.00	0.79	0.79	0.79	0.79	0.79	0.79
k3a0.5r1.0	117	1.71	0.26	1.71	1.71	2.56	2.56	2.56	2.56
k3a0.7r0.1	168	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k3a0.7r0.3	159	1.26	0.44	1.26	1.26	1.26	1.26	1.89	1.64
k3a0.7r0.5	155	0.00	0.00	0.65	0.65	1.29	1.29	1.29	1.29
k3a0.7r0.7	156	1.28	0.32	1.92	1.92	2.56	2.56	3.21	2.63
k3a0.7r1.0	151	2.65	1.13	3.31	3.31	4.64	3.77	4.64	4.64
k3a1.0r0.1	193	0.52	0.05	0.52	0.52	0.52	0.52	0.52	0.52
k3a1.0r0.3	168	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k3a1.0r0.5	199	0.50	0.10	1.01	1.01	1.01	1.01	1.51	1.51
k3a1.0r0.7	190	0.00	0.00	1.05	1.05	1.05	1.05	1.58	1.58
k3a1.0r1.0	181	0.00	0.00	1.10	1.10	1.66	1.66	1.66	1.66
k5a0.1r0.1	50	10.00	8.20	8.00	7.00	2.00	2.00	10.00	9.60
k5a0.1r0.3	48	22.92	21.04	22.92	22.50	6.25	5.83	22.92	22.08
k5a0.1r0.5	62	12.90	11.94	14.52	12.58	9.68	6.77	12.90	11.61
k5a0.1r0.7	53	16.98	15.66	20.75	17.36	5.66	3.96	18.87	16.42
k5a0.1r1.0	50	14.00	13.40	20.00	17.40	12.00	12.00	16.00	14.80
k5a0.3r0.1	138	3.62	1.96	2.90	2.17	4.35	4.35	5.07	4.35
k5a0.3r0.3	126	2.38	1.51	1.59	1.59	2.38	2.38	3.17	2.70
k5a0.3r0.5	122	2.46	1.80	3.28	1.89	4.10	3.69	4.10	3.77
k5a0.3r0.7	117	2.56	1.28	4.27	1.79	5.13	4.53	5.13	4.36
k5a0.3r1.0	128	2.34	1.17	2.34	1.25	3.13	2.50	3.13	2.50
k5a0.5r0.1	188	0.53	0.16	0.53	0.53	1.06	1.01	1.06	1.06
k5a0.5r0.3	185	0.00	0.00	0.54	0.54	0.54	0.54	0.54	0.54
k5a0.5r0.5	191	1.05	0.31	0.52	0.52	1.57	1.57	1.57	1.57
k5a0.5r0.7	180	0.00	0.00	0.56	0.56	1.11	1.11	1.11	1.11
k5a0.5r1.0	178	0.00	0.00	0.56	0.56	1.69	1.18	1.69	1.69
k5a0.7r0.1	218	0.00	0.00	0.46	0.46	0.92	0.92	0.92	0.92
k5a0.7r0.3	228	0.00	0.00	0.00	0.00	0.44	0.44	0.44	0.44
k5a0.7r0.5	220	0.00	0.00	0.00	0.00	0.91	0.64	0.91	0.91
k5a0.7r0.7	229	0.87	0.17	0.87	0.87	2.18	1.79	2.62	2.40
k5a0.7r1.0	225	0.44	0.04	1.33	1.33	1.78	1.78	2.22	1.82
k5a1.0r0.1	273	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.37

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30 minutes	FF	FF- GRASP		FF-ILS		BR-FF		BR-FF-VND	
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k5a1.0r0.3	282	0.71	0.11	0.71	0.07	1.06	1.06	1.06	1.06
k5a1.0r0.5	281	0.00	0.00	0.00	0.00	0.36	0.36	0.36	0.36
k5a1.0r0.7	291	0.00	0.00	0.69	0.69	1.03	0.79	1.03	0.96
k5a1.0r1.0	280	0.00	0.00	1.79	1.79	1.43	1.11	2.14	2.14
k7a0.1r0.1	78	10.26	8.97	11.54	10.38	3.85	3.21	11.54	9.74
k7a0.1r0.3	78	21.79	18.33	23.08	20.64	17.95	15.64	20.51	18.97
k7a0.1r0.5	75	10.67	7.60	10.67	10.13	9.33	7.47	10.67	10.00
k7a0.1r0.7	70	8.57	6.57	10.00	8.29	4.29	3.29	10.00	10.00
k7a0.1r1.0	65	12.31	11.23	12.31	12.15	10.77	10.31	12.31	12.31
k7a0.3r0.1	159	6.29	4.97	6.92	5.72	6.29	6.23	7.55	6.79
k7a0.3r0.3	183	1.64	0.82	1.09	1.09	1.64	1.64	2.19	2.19
k7a0.3r0.5	159	3.14	2.52	3.77	2.26	4.40	3.84	4.40	4.09
k7a0.3r0.7	165	2.42	1.82	2.42	1.76	3.64	3.21	3.64	3.52
k7a0.3r1.0	150	2.00	1.47	2.00	2.00	2.00	1.93	3.33	3.13
k7a0.5r0.1	245	0.41	0.16	0.82	0.82	0.82	0.82	1.63	1.39
k7a0.5r0.3	256	0.00	0.00	0.00	0.00	0.39	0.08	0.39	0.20
k7a0.5r0.5	229	1.31	0.66	1.75	1.00	1.75	1.44	2.62	2.10
k7a0.5r0.7	241	0.41	0.12	0.83	0.83	2.07	1.78	1.66	1.66
k7a0.5r1.0	255	0.00	0.00	0.00	0.00	1.18	0.86	1.18	1.06
k7a0.7r0.1	276	1.09	0.43	2.17	2.17	1.45	1.30	2.54	2.54
k7a0.7r0.3	302	0.99	0.30	0.99	0.99	1.66	1.39	2.32	1.92
k7a0.7r0.5	306	0.00	0.00	0.33	0.33	0.33	0.33	0.65	0.62
k7a0.7r0.7	293	1.02	0.34	2.05	2.05	3.41	3.21	3.41	3.17
k7a0.7r1.0	295	0.00	0.00	0.00	0.00	1.36	1.36	1.69	1.39
k7a1.0r0.1	393	0.00	0.00	0.51	0.51	0.51	0.51	0.76	0.56
k7a1.0r0.3	347	0.86	0.32	1.15	1.15	1.15	1.12	1.15	1.15
k7a1.0r0.5	341	0.29	0.03	0.59	0.59	0.88	0.88	0.88	0.88
k7a1.0r0.7	348	1.44	0.75	1.72	1.47	2.01	1.95	2.01	2.01
k7a1.0r1.0	330	0.00	0.00	0.30	0.30	0.30	0.18	0.30	0.30
k10a0.1r0.1	99	12.12	12.12	12.12	11.41	8.08	6.57	11.11	11.11
k10a0.1r0.3	93	21.51	18.49	22.58	18.71	8.60	7.63	20.43	18.49
k10a0.1r0.5	98	24.49	23.57	23.47	23.47	18.37	17.86	25.51	23.67
k10a0.1r0.7	89	8.99	7.53	8.99	7.19	7.87	3.15	8.99	7.98
k10a0.1r1.0	86	15.12	13.37	15.12	14.77	6.98	5.81	15.12	14.42
k10a0.3r0.1	246	4.07	2.89	3.66	2.97	4.07	3.70	4.07	3.82
k10a0.3r0.3	226	3.10	1.15	3.10	1.64	2.21	1.90	4.42	3.98
k10a0.3r0.5	217	2.30	1.75	2.76	2.12	4.61	4.42	3.23	3.18
k10a0.3r0.7	216	1.39	0.88	1.85	1.02	2.31	1.94	2.78	2.22
k10a0.3r1.0	229	3.06	2.18	3.93	2.40	3.49	3.06	4.80	3.80
k10a0.5r0.1	362	0.55	0.19	0.83	0.64	0.83	0.83	1.38	1.22
k10a0.5r0.3	330	1.52	0.67	1.21	0.97	2.42	2.27	3.03	2.52
k10a0.5r0.5	318	1.26	0.57	1.26	1.26	2.20	2.01	2.83	2.36
k10a0.5r0.7	314	1.27	0.70	1.27	1.27	1.59	1.31	1.91	1.85

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30 minutes	FF	FF- GRASP		FF-ILS		BR-FF		BR-FF-VND	
Instance	BestSol	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev	BestDev	AvgDev
k10a0.5r1.0	315	0.63	0.13	0.95	0.95	0.95	0.92	1.27	1.02
k10a0.7r0.1	431	0.00	0.00	0.46	0.46	1.39	0.95	1.39	1.07
k10a0.7r0.3	440	0.00	0.00	0.00	0.00	0.68	0.68	0.91	0.89
k10a0.7r0.5	419	0.00	0.00	0.48	0.48	1.43	1.19	1.91	1.48
k10a0.7r0.7	389	0.26	0.03	1.03	1.03	1.54	1.34	1.80	1.62
k10a0.7r1.0	410	0.73	0.17	0.73	0.73	1.22	0.85	1.95	1.71
k10a1.0r0.1	567	0.71	0.26	0.71	0.71	0.88	0.72	1.06	1.06
k10a1.0r0.3	514	0.19	0.06	0.39	0.39	0.19	0.19	0.78	0.60
k10a1.0r0.5	473	0.63	0.17	0.85	0.30	1.27	1.01	1.48	1.16
k10a1.0r0.7	527	0.00	0.00	0.57	0.57	0.57	0.51	0.95	0.82
k10a1.0r1.0	467	0.86	0.19	1.07	1.07	0.86	0.73	1.28	1.26
Average	163.71	3.10	2.52	3.48	3.12	3.12	2.79	4.09	3.75

Table 1.4: Relative deviations for best solutions (DevBest %) and average of best solutions (AvgDev %) to the FF heuristic for 30 minutes stop time criterion

1.2

Stochastic Environment Results

1.2.1

Permutation flow shop problem with delivery dates. cumulative payoff and stochastic times - PFSPDPST

On this Section the results aforementioned on Table 5.3 and 5.4 are shown. Each Table contains the 150 instances mentioned in Section 5.1. For each instance. the best solution provided by BR-FF-VND metaheuristic and their deviation with proposed Sim BR-FF-VND were shown. Moreover. the Value at Risk (VaR_α) and Conditional Value at Risk ($CVaR_\alpha$) of the best stochastic solution were illustrated with for three different levels of confidence.

Instance	BR-FF-VND	Sim BR-FF-VND (0.1)		VaR_α			$CVaR_\alpha$		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k1a0.1r0.1	21.00	-0.05	-0.12	21.00	21.00	20.00	20.80	20.60	20.00
k1a0.1r0.3	22.00	0.00	-0.01	22.00	22.00	22.00	22.00	22.00	22.00
k1a0.1r0.5	21.00	-0.07	-0.38	21.00	21.00	20.00	20.70	20.40	20.00
k1a0.1r0.7	17.00	-0.02	-0.37	17.00	17.00	17.00	16.92	16.84	16.60
k1a0.1r1.0	20.00	-0.08	-0.87	20.00	20.00	19.00	19.70	19.40	19.00
k1a0.3r0.1	46.00	-0.03	-0.50	46.00	46.00	45.00	45.76	45.52	44.80

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Instance	BR-FF-VND			Sim BR-FF-VND (0.1)			VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%			
k1a0.3r0.3	45.00	1.34	0.43	45.00	45.00	45.00	45.00	45.00	45.00			
k1a0.3r0.5	46.00	0.11	0.01	46.00	44.00	44.00	44.40	44.00	44.00			
k1a0.3r0.7	47.00	-0.01	-0.03	47.00	47.00	47.00	46.90	46.80	46.50			
k1a0.3r1.0	44.00	0.00	-0.70	44.00	44.00	44.00	44.00	44.00	44.00			
k1a0.5r0.1	65.00	0.01	-0.01	65.00	65.00	65.00	65.00	65.00	65.00			
k1a0.5r0.3	63.00	-0.01	-0.04	63.00	63.00	63.00	62.86	62.72	62.30			
k1a0.5r0.5	67.00	0.18	0.06	67.00	67.00	67.00	67.00	67.00	67.00			
k1a0.5r0.7	66.00	-0.18	-0.98	65.00	64.00	64.00	64.06	64.00	64.00			
k1a0.5r1.0	60.00	-0.01	-0.63	60.00	60.00	60.00	59.90	59.80	59.50			
k1a0.7r0.1	81.00	0.00	-0.69	81.00	81.00	81.00	81.00	81.00	81.00			
k1a0.7r0.3	81.00	0.05	0.01	81.00	80.00	80.00	80.18	79.92	79.80			
k1a0.7r0.5	80.00	0.00	0.00	80.00	80.00	80.00	80.00	80.00	80.00			
k1a0.7r0.7	79.00	0.03	-0.07	79.00	78.00	78.00	78.40	78.00	78.00			
k1a0.7r1.0	79.00	-0.02	-0.22	79.00	79.00	78.00	78.70	78.40	78.00			
k1a1.0r0.1	99.00	0.12	0.07	99.00	99.00	99.00	99.00	99.00	99.00			
k1a1.0r0.3	99.00	0.00	-0.01	99.00	99.00	99.00	99.00	99.00	99.00			
k1a1.0r0.5	99.00	0.29	0.04	99.00	99.00	99.00	99.00	99.00	99.00			
k1a1.0r0.7	98.00	-0.01	-0.04	98.00	98.00	97.00	97.80	97.60	97.00			
k1a1.0r1.0	98.00	-0.24	-0.89	97.00	96.00	96.00	96.18	95.88	95.70			
k2a0.1r0.1	29.00	-0.07	-3.62	29.00	29.00	28.00	28.60	28.20	27.20			
k2a0.1r0.3	30.00	-0.38	-1.55	29.00	29.00	29.00	29.00	29.00	29.00			
k2a0.1r0.5	28.00	-0.18	-0.61	28.00	27.00	26.00	27.00	26.60	26.00			
k2a0.1r0.7	30.00	-0.18	-0.85	29.00	29.00	29.00	29.00	29.00	29.00			
k2a0.1r1.0	27.00	-0.44	-3.62	26.00	26.00	26.00	25.92	25.84	25.60			
k2a0.3r0.1	72.00	-0.15	-1.07	71.00	71.00	71.00	70.90	70.80	70.50			
k2a0.3r0.3	68.00	-0.02	-0.30	68.00	68.00	67.00	67.70	67.40	67.00			
k2a0.3r0.5	62.00	0.00	-0.10	62.00	62.00	62.00	62.00	62.00	62.00			
k2a0.3r0.7	71.00	0.37	-0.94	71.00	70.00	70.00	69.98	69.64	69.10			
k2a0.3r1.0	64.00	-0.03	-0.35	64.00	64.00	63.00	63.60	63.20	63.00			
k2a0.5r0.1	100.00	0.00	-0.02	100.00	100.00	100.00	100.00	100.00	100.00			
k2a0.5r0.3	98.00	0.13	-0.01	98.00	98.00	98.00	97.86	97.72	97.30			
k2a0.5r0.5	99.00	-0.04	-0.83	99.00	99.00	97.00	98.30	97.60	97.00			
k2a0.5r0.7	94.00	-0.02	-0.69	94.00	94.00	93.00	93.56	93.12	92.70			
k2a0.5r1.0	86.00	0.44	0.00	86.00	86.00	85.00	85.70	85.40	85.00			
k2a0.7r0.1	118.00	0.01	-0.02	118.00	118.00	118.00	117.90	117.80	117.50			
k2a0.7r0.3	115.00	-0.01	-0.03	115.00	115.00	115.00	114.84	114.68	114.20			
k2a0.7r0.5	114.00	0.34	-0.03	114.00	113.00	112.00	112.86	112.28	111.30			
k2a0.7r0.7	118.00	0.00	-0.17	118.00	118.00	118.00	117.90	117.80	117.50			
k2a0.7r1.0	111.00	-0.04	-0.21	111.00	110.00	110.00	110.02	109.76	109.40			
k2a1.0r0.1	151.00	-0.01	-0.02	151.00	151.00	151.00	150.78	150.56	149.90			
k2a1.0r0.3	150.00	0.00	-0.04	150.00	150.00	150.00	149.90	149.80	149.50			
k2a1.0r0.5	154.00	-0.01	-0.07	154.00	154.00	153.00	153.80	153.60	153.00			
k2a1.0r0.7	150.00	0.46	0.41	150.00	150.00	150.00	149.84	149.68	149.20			
k2a1.0r1.0	142.00	-0.15	-0.46	141.00	140.00	140.00	140.42	140.00	140.00			

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Instance	BR-FF-VND			Sim BR-FF-VND (0.1)			VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%			
k3a0.1r0.1	39.00	0.11	0.01	39.00	39.00	38.00	38.72	38.44	38.00			
k3a0.1r0.3	33.00	-1.04	-3.99	31.00	31.00	31.00	31.00	31.00	31.00			
k3a0.1r0.5	38.00	-0.49	-2.86	36.00	36.00	36.00	35.90	35.80	35.50			
k3a0.1r0.7	38.00	1.99	0.71	38.00	38.00	38.00	37.98	37.96	37.90			
k3a0.1r1.0	36.00	-0.17	-3.10	35.00	35.00	34.00	34.80	34.60	34.00			
k3a0.3r0.1	91.00	-0.09	-0.43	90.00	90.00	89.00	89.72	89.44	88.90			
k3a0.3r0.3	92.00	0.14	-0.63	91.00	90.00	90.00	90.48	90.00	90.00			
k3a0.3r0.5	85.00	0.45	-0.89	84.00	83.00	83.00	83.30	82.80	82.50			
k3a0.3r0.7	90.00	0.53	0.42	89.00	89.00	88.00	88.60	88.20	88.00			
k3a0.3r1.0	87.00	0.30	-0.71	87.00	86.00	85.00	85.90	85.60	85.00			
k3a0.5r0.1	128.00	-0.03	-0.12	127.00	127.00	127.00	126.90	126.80	126.50			
k3a0.5r0.3	130.00	-0.36	-0.82	128.00	128.00	128.00	127.82	127.64	127.10			
k3a0.5r0.5	126.00	-0.08	-0.44	125.00	125.00	125.00	125.00	125.00	125.00			
k3a0.5r0.7	128.00	-0.08	-0.11	127.00	127.00	127.00	126.90	126.80	126.50			
k3a0.5r1.0	120.00	-0.05	-0.48	119.00	119.00	119.00	118.90	118.80	118.50			
k3a0.7r0.1	168.00	0.00	-0.02	168.00	168.00	167.00	167.60	167.20	167.00			
k3a0.7r0.3	162.00	-0.25	-0.64	160.00	159.00	159.00	159.40	158.84	158.60			
k3a0.7r0.5	157.00	-0.02	-0.23	157.00	156.00	156.00	156.50	156.00	156.00			
k3a0.7r0.7	160.00	0.26	-0.09	160.00	160.00	160.00	159.82	159.64	159.10			
k3a0.7r1.0	157.00	0.78	-0.33	157.00	156.00	156.00	156.20	155.92	155.80			
k3a1.0r0.1	194.00	0.00	-0.07	194.00	194.00	194.00	193.90	193.80	193.50			
k3a1.0r0.3	168.00	0.00	-0.01	168.00	168.00	168.00	167.90	167.80	167.50			
k3a1.0r0.5	202.00	-0.04	-0.40	201.00	201.00	201.00	200.86	200.72	200.30			
k3a1.0r0.7	193.00	-0.05	-0.43	192.00	191.00	191.00	191.30	191.00	191.00			
k3a1.0r1.0	184.00	-0.06	-0.59	183.00	183.00	183.00	183.00	183.00	183.00			
k5a0.1r0.1	54.00	0.64	-1.73	53.00	53.00	53.00	53.00	53.00	53.00			
k5a0.1r0.3	58.00	0.64	0.33	57.00	57.00	55.00	56.50	56.00	54.50			
k5a0.1r0.5	69.00	-0.07	-1.05	69.00	68.00	67.00	67.80	67.40	67.00			
k5a0.1r0.7	61.00	-0.26	-2.93	60.00	59.00	57.00	58.80	58.00	57.00			
k5a0.1r1.0	58.00	0.12	-5.73	56.00	56.00	55.00	55.70	55.40	55.00			
k5a0.3r0.1	144.00	-0.04	-0.75	144.00	143.00	142.00	142.86	142.28	141.70			
k5a0.3r0.3	129.00	0.13	-0.13	128.00	127.00	126.00	127.18	126.60	126.00			
k5a0.3r0.5	126.00	0.16	-0.50	124.00	124.00	123.00	123.60	123.20	123.00			
k5a0.3r0.7	123.00	-0.06	-2.21	122.00	121.00	120.00	120.90	120.40	119.50			
k5a0.3r1.0	131.00	0.19	-0.33	130.00	130.00	130.00	130.00	130.00	130.00			
k5a0.5r0.1	190.00	-0.04	-0.34	189.00	189.00	189.00	188.80	188.60	188.00			
k5a0.5r0.3	186.00	0.06	-0.04	185.00	185.00	184.00	184.50	184.00	183.50			
k5a0.5r0.5	194.00	0.18	-0.19	193.00	193.00	192.00	192.50	192.00	191.50			
k5a0.5r0.7	182.00	0.00	-0.34	182.00	182.00	181.00	181.80	181.60	181.00			
k5a0.5r1.0	181.00	0.04	-0.51	180.00	180.00	180.00	180.00	180.00	180.00			
k5a0.7r0.1	220.00	0.01	-0.20	219.00	218.00	218.00	217.84	217.48	216.70			
k5a0.7r0.3	229.00	-0.01	-0.07	229.00	229.00	228.00	228.70	228.40	228.00			
k5a0.7r0.5	222.00	-0.07	-0.21	221.00	221.00	220.00	220.52	220.04	219.70			
k5a0.7r0.7	234.00	-0.08	-0.53	233.00	232.00	231.00	231.90	231.60	231.00			

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Instance	BR-FF-VND			Sim BR-FF-VND (0.1)			VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%	95%	97.5%	99%
k5a0.7r1.0	229.00	0.48	-0.09	228.00	228.00	227.00	227.64	227.28	226.40			
k5a1.0r0.1	274.00	0.07	-0.20	273.00	272.00	272.00	272.50	272.00	272.00			
k5a1.0r0.3	285.00	-0.11	-0.48	283.00	283.00	282.00	282.60	282.20	281.50			
k5a1.0r0.5	282.00	0.59	0.10	282.00	282.00	281.00	281.52	281.04	281.00			
k5a1.0r0.7	293.00	0.02	-0.05	292.00	292.00	292.00	292.00	292.00	292.00			
k5a1.0r1.0	286.00	-0.09	-0.29	285.00	285.00	283.00	284.40	283.80	283.00			
k7a0.1r0.1	85.00	-0.17	-1.51	84.00	83.00	83.00	83.50	83.00	83.00			
k7a0.1r0.3	91.00	0.43	-2.07	90.00	89.00	89.00	89.20	88.80	88.50			
k7a0.1r0.5	82.00	-0.08	-3.62	81.00	81.00	79.00	80.08	79.16	78.00			
k7a0.1r0.7	77.00	0.01	-3.61	75.00	74.00	73.00	74.10	73.40	72.50			
k7a0.1r1.0	73.00	0.21	-1.45	72.00	70.00	70.00	70.40	69.60	69.00			
k7a0.3r0.1	170.00	-0.25	-2.15	168.00	166.00	166.00	166.70	165.80	165.50			
k7a0.3r0.3	187.00	0.19	-0.58	185.00	184.00	183.00	184.04	183.20	182.10			
k7a0.3r0.5	165.00	0.31	-0.64	164.00	163.00	163.00	163.40	162.80	162.50			
k7a0.3r0.7	171.00	0.05	-0.59	170.00	170.00	169.00	169.48	168.96	168.40			
k7a0.3r1.0	154.00	0.03	-0.41	151.00	151.00	149.00	150.40	149.80	149.00			
k7a0.5r0.1	248.00	0.14	-0.35	247.00	245.00	244.00	244.90	243.60	242.00			
k7a0.5r0.3	256.00	0.19	0.07	253.00	253.00	252.00	252.50	252.00	251.50			
k7a0.5r0.5	233.00	-0.06	-0.47	232.00	231.00	230.00	231.04	230.12	228.90			
k7a0.5r0.7	245.00	-0.11	-0.44	243.00	243.00	242.00	242.60	242.20	242.00			
k7a0.5r1.0	257.00	-0.05	-0.43	256.00	255.00	254.00	254.84	254.16	253.00			
k7a0.7r0.1	283.00	-0.16	-0.46	281.00	280.00	280.00	280.30	279.72	279.30			
k7a0.7r0.3	307.00	-0.09	-0.63	305.00	305.00	303.00	304.20	303.40	302.50			
k7a0.7r0.5	307.00	0.55	0.44	307.00	307.00	306.00	306.38	305.76	305.00			
k7a0.7r0.7	302.00	-0.07	-0.87	300.00	300.00	300.00	299.90	299.80	299.50			
k7a0.7r1.0	299.00	-0.03	-0.48	298.00	297.00	296.00	297.10	296.44	295.70			
k7a1.0r0.1	395.00	-0.04	-0.11	393.00	393.00	393.00	393.00	393.00	393.00			
k7a1.0r0.3	351.00	0.03	-0.06	351.00	350.00	350.00	350.30	350.00	350.00			
k7a1.0r0.5	344.00	-0.02	-0.21	343.00	343.00	342.00	342.50	342.00	341.50			
k7a1.0r0.7	355.00	-0.12	-0.27	353.00	353.00	352.00	352.60	352.20	352.00			
k7a1.0r1.0	331.00	-0.04	-0.07	330.00	330.00	329.00	329.80	329.60	329.00			
k10a0.1r0.1	110.00	0.14	-1.78	108.00	108.00	106.00	107.10	106.20	105.00			
k10a0.1r0.3	109.00	0.07	-0.72	105.00	103.00	102.00	103.30	102.40	101.50			
k10a0.1r0.5	121.00	0.20	-0.41	119.00	117.00	117.00	117.60	116.60	116.00			
k10a0.1r0.7	96.00	-0.04	-1.77	94.00	92.00	92.00	92.28	91.56	90.90			
k10a0.1r1.0	99.00	-0.18	-2.74	97.00	97.00	96.00	96.60	96.20	96.00			
k10a0.3r0.1	256.00	0.09	-0.85	253.00	252.00	251.00	252.00	251.20	250.50			
k10a0.3r0.3	235.00	0.23	-1.73	234.00	233.00	233.00	233.40	233.00	233.00			
k10a0.3r0.5	224.00	0.25	-0.62	223.00	223.00	221.00	222.60	222.20	221.00			
k10a0.3r0.7	220.00	-0.20	-0.68	216.00	215.00	214.00	214.92	214.20	213.80			
k10a0.3r1.0	236.00	-0.14	-0.75	232.00	230.00	230.00	230.60	229.60	229.00			
k10a0.5r0.1	365.00	-0.01	-0.19	364.00	364.00	363.00	363.70	363.40	363.00			
k10a0.5r0.3	336.00	-0.14	-0.54	334.00	333.00	332.00	332.52	331.96	331.20			
k10a0.5r0.5	325.00	-0.27	-0.42	322.00	322.00	321.00	321.60	321.20	320.80			

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Instance	BR-FF-VND	Sim BR-FF-VND (0.1)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k10a0.5r0.7	319.00	0.51	0.15	318.00	317.00	316.00	316.60	316.00	315.50
k10a0.5r1.0	318.00	0.17	-0.17	315.00	315.00	314.00	314.60	314.20	313.50
k10a0.7r0.1	435.00	-0.10	-0.26	433.00	432.00	432.00	432.32	431.72	431.30
k10a0.7r0.3	443.00	-0.01	-0.23	440.00	439.00	438.00	439.06	438.32	437.40
k10a0.7r0.5	426.00	-0.14	-0.77	424.00	424.00	423.00	423.60	423.20	422.50
k10a0.7r0.7	395.00	-0.13	-0.49	393.00	392.00	391.00	391.70	391.00	390.50
k10a0.7r1.0	416.00	0.01	-0.37	415.00	414.00	413.00	413.64	413.24	412.60
k10a1.0r0.1	573.00	-0.08	-0.21	571.00	570.00	569.00	569.74	568.76	567.90
k10a1.0r0.3	517.00	-0.08	-0.22	515.00	514.00	514.00	514.40	513.84	513.60
k10a1.0r0.5	478.00	-0.04	-0.26	476.00	476.00	476.00	475.90	475.80	475.50
k10a1.0r0.7	531.00	0.08	-0.10	530.00	529.00	528.00	528.44	527.48	525.90
k10a1.0r1.0	473.00	-0.05	-0.31	471.00	470.00	470.00	470.30	469.60	469.00
Average	167.29	0.04	-0.62						

Table 1.5: Relative deviations for the Simheuristic best solutions (DevBest %) and average of best solutions (AvgDev %) with a level of uncertainty equal to 0.1 to the BR-FF-VND with 1 minute stop time criterion and the Value at Risk (VaR α) and Conditional-Value-at-Risk (CVaR α) with three levels of confidence (95%, 97.5% and 99%) of the Simheuristic best solution

Instance	BR-FF-VND	Sim BR-FF-VND (0.5)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k1a0.1r0.1	21.00	-1.02	-1.37	20.00	20.00	19.00	19.70	19.40	19.00
k1a0.1r0.3	22.00	-0.73	-0.94	21.00	21.00	21.00	21.00	21.00	21.00
k1a0.1r0.5	21.00	-1.29	-2.71	20.00	19.00	19.00	19.40	19.00	19.00
k1a0.1r0.7	17.00	-1.35	-2.33	16.00	16.00	15.00	15.80	15.60	15.00
k1a0.1r1.0	20.00	-1.10	-3.02	19.00	19.00	19.00	18.90	18.80	18.50
k1a0.3r0.1	46.00	-0.64	-1.58	45.00	45.00	43.00	44.50	44.00	43.00
k1a0.3r0.3	45.00	0.07	-0.31	44.00	44.00	44.00	44.00	44.00	44.00
k1a0.3r0.5	46.00	-0.35	-0.58	44.00	44.00	44.00	44.00	44.00	44.00
k1a0.3r0.7	47.00	-0.49	-0.66	46.00	46.00	45.00	45.60	45.20	45.00
k1a0.3r1.0	44.00	-0.30	-1.31	43.00	43.00	41.00	42.40	41.80	41.00
k1a0.5r0.1	65.00	-0.29	-0.44	64.00	64.00	63.00	63.80	63.60	63.00
k1a0.5r0.3	63.00	-0.42	-0.64	62.00	61.00	61.00	61.46	60.96	60.90
k1a0.5r0.5	67.00	0.01	-0.05	67.00	66.00	66.00	66.20	65.80	65.50
k1a0.5r0.7	66.00	-1.55	-1.91	65.00	63.00	63.00	63.70	63.00	63.00
k1a0.5r1.0	60.00	-0.63	-1.71	59.00	58.00	57.00	57.90	57.40	56.50
k1a0.7r0.1	81.00	-0.41	-1.17	79.00	79.00	79.00	79.00	79.00	79.00
k1a0.7r0.3	81.00	-0.19	-0.31	80.00	79.00	79.00	79.00	78.80	78.50

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Instance	BR-FF-VND	Sim BR-FF-VND (0.5)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k1a0.7r0.5	80.00	-0.26	-0.38	79.00	79.00	78.00	78.50	78.00	77.50
k1a0.7r0.7	79.00	-0.34	-0.59	78.00	78.00	77.00	77.60	77.20	76.90
k1a0.7r1.0	79.00	-0.53	-0.81	77.00	77.00	76.00	76.70	76.40	76.00
k1a1.0r0.1	99.00	0.04	-0.02	98.00	98.00	98.00	98.00	98.00	98.00
k1a1.0r0.3	99.00	-0.16	-0.28	97.00	97.00	97.00	97.00	97.00	97.00
k1a1.0r0.5	99.00	0.18	-0.19	98.00	98.00	98.00	98.00	98.00	98.00
k1a1.0r0.7	98.00	-0.23	-0.39	96.00	96.00	96.00	96.00	96.00	96.00
k1a1.0r1.0	98.00	-1.10	-1.26	96.00	96.00	95.00	95.60	95.20	95.00
k2a0.1r0.1	29.00	-1.34	-5.15	27.00	27.00	26.00	26.54	26.08	25.70
k2a0.1r0.3	30.00	-2.03	-2.90	28.00	28.00	28.00	28.00	28.00	28.00
k2a0.1r0.5	28.00	-2.07	-3.39	25.00	25.00	25.00	25.00	25.00	25.00
k2a0.1r0.7	30.00	-2.02	-3.24	28.00	27.00	27.00	27.20	27.00	27.00
k2a0.1r1.0	27.00	-2.78	-5.73	24.00	24.00	22.00	23.30	22.60	22.00
k2a0.3r0.1	72.00	-1.64	-1.72	69.00	69.00	68.00	68.80	68.60	68.00
k2a0.3r0.3	68.00	-0.85	-1.34	66.00	65.00	65.00	65.20	65.00	65.00
k2a0.3r0.5	62.00	-0.47	-0.92	60.00	60.00	59.00	59.50	59.00	58.50
k2a0.3r0.7	71.00	-0.74	-1.77	68.00	68.00	68.00	68.00	68.00	68.00
k2a0.3r1.0	64.00	-1.02	-1.61	61.00	61.00	61.00	60.90	60.80	60.50
k2a0.5r0.1	100.00	-0.13	-0.30	99.00	99.00	98.00	98.68	98.36	97.90
k2a0.5r0.3	98.00	-0.09	-0.46	96.00	96.00	94.00	95.38	94.76	94.00
k2a0.5r0.5	99.00	-0.66	-1.49	96.00	95.00	94.00	95.10	94.60	94.00
k2a0.5r0.7	94.00	-1.10	-1.58	90.00	90.00	89.00	89.68	89.36	89.00
k2a0.5r1.0	86.00	-0.08	-0.77	85.00	85.00	85.00	84.90	84.80	84.50
k2a0.7r0.1	118.00	-0.64	-0.71	116.00	115.00	115.00	115.24	114.80	114.50
k2a0.7r0.3	115.00	-0.39	-0.53	113.00	112.00	112.00	112.30	111.80	111.50
k2a0.7r0.5	114.00	-0.38	-0.53	112.00	112.00	110.00	111.50	111.00	109.50
k2a0.7r0.7	118.00	-0.28	-0.75	116.00	115.00	115.00	115.26	114.80	114.50
k2a0.7r1.0	111.00	-0.84	-1.20	109.00	109.00	107.00	108.20	107.40	106.50
k2a1.0r0.1	151.00	-0.16	-0.22	149.00	149.00	148.00	148.60	148.20	148.00
k2a1.0r0.3	150.00	-0.13	-0.26	149.00	149.00	148.00	148.80	148.60	148.00
k2a1.0r0.5	154.00	-0.25	-0.43	152.00	151.00	151.00	151.30	150.60	150.00
k2a1.0r0.7	150.00	0.01	-0.05	149.00	149.00	148.00	148.78	148.56	148.00
k2a1.0r1.0	142.00	-0.70	-1.01	139.00	139.00	139.00	138.90	138.80	138.50
k3a0.1r0.1	39.00	-0.56	-0.81	37.00	36.00	36.00	36.40	36.00	36.00
k3a0.1r0.3	33.00	-3.29	-6.51	29.00	29.00	29.00	28.96	28.92	28.80
k3a0.1r0.5	38.00	-3.30	-5.20	34.00	34.00	33.00	33.60	33.20	32.50
k3a0.1r0.7	38.00	1.20	-0.96	37.00	36.00	36.00	36.40	36.00	36.00
k3a0.1r1.0	36.00	-2.08	-4.88	33.00	32.00	31.00	31.94	31.28	30.70
k3a0.3r0.1	91.00	-1.01	-1.35	88.00	87.00	86.00	86.84	86.40	85.80
k3a0.3r0.3	92.00	-1.08	-1.48	89.00	88.00	88.00	87.98	87.84	87.60
k3a0.3r0.5	85.00	-1.08	-2.01	82.00	82.00	81.00	81.60	81.20	81.00
k3a0.3r0.7	90.00	-1.02	-1.20	86.00	85.00	85.00	85.50	85.00	85.00
k3a0.3r1.0	87.00	-0.92	-1.68	83.00	82.00	82.00	82.50	82.00	82.00

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Instance	BR-FF-VND			VaR α			CVaR α		
	BestSol	Sim BestDev (%)	BR-FF-VND (0.5) AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k3a0.5r0.1	128.00	-0.56	-0.87	125.00	125.00	124.00	124.80	124.60	124.00
k3a0.5r0.3	129.00	-0.52	-0.74	127.00	125.00	125.00	125.48	124.96	124.90
k3a0.5r0.5	126.00	-0.90	-1.16	123.00	122.00	121.00	122.08	121.40	120.60
k3a0.5r0.7	128.00	-0.58	-0.72	126.00	125.00	123.00	124.80	123.80	122.50
k3a0.5r1.0	120.00	-0.97	-1.48	116.00	116.00	115.00	115.74	115.48	114.70
k3a0.7r0.1	168.00	-0.32	-0.46	166.00	165.00	165.00	165.50	165.00	165.00
k3a0.7r0.3	161.00	-0.50	-0.60	158.00	157.00	157.00	157.32	156.88	156.70
k3a0.7r0.5	157.00	-0.65	-0.90	153.00	152.00	152.00	152.42	151.92	151.80
k3a0.7r0.7	160.00	-0.19	-0.61	157.00	157.00	157.00	156.84	156.68	156.20
k3a0.7r1.0	157.00	0.01	-0.82	153.00	152.00	151.00	152.06	151.20	150.50
k3a1.0r0.1	194.00	-0.18	-0.34	192.00	192.00	191.00	191.70	191.40	191.00
k3a1.0r0.3	168.00	-0.10	-0.18	167.00	167.00	167.00	167.00	167.00	167.00
k3a1.0r0.5	202.00	-0.39	-0.64	199.00	199.00	198.00	198.80	198.60	198.00
k3a1.0r0.7	193.00	-0.53	-0.83	189.00	189.00	188.00	188.50	188.00	187.50
k3a1.0r1.0	184.00	-0.61	-1.11	180.00	180.00	179.00	179.40	178.80	178.10
k5a0.1r0.1	54.00	-0.23	-3.42	51.00	51.00	49.00	50.30	49.60	48.50
k5a0.1r0.3	58.00	-1.56	-1.73	52.00	51.00	49.00	50.60	49.80	48.50
k5a0.1r0.5	69.00	-1.70	-3.15	64.00	63.00	62.00	63.10	62.60	62.00
k5a0.1r0.7	61.00	-2.11	-5.66	56.00	55.00	54.00	54.76	54.04	53.20
k5a0.1r1.0	58.00	-2.09	-7.79	53.00	52.00	50.00	51.50	50.80	49.50
k5a0.3r0.1	144.00	-0.74	-1.78	139.00	138.00	138.00	138.10	137.52	136.80
k5a0.3r0.3	129.00	-1.06	-1.44	124.00	123.00	122.00	122.60	121.80	121.00
k5a0.3r0.5	126.00	-0.65	-1.35	122.00	122.00	121.00	121.34	120.68	120.00
k5a0.3r0.7	123.00	-1.02	-3.00	120.00	119.00	118.00	118.60	118.00	117.50
k5a0.3r1.0	131.00	-0.58	-1.21	127.00	125.00	123.00	125.20	124.20	123.00
k5a0.5r0.1	190.00	-0.69	-0.85	185.00	183.00	183.00	183.30	182.40	181.50
k5a0.5r0.3	186.00	-0.45	-0.63	183.00	181.00	180.00	181.30	180.40	179.50
k5a0.5r0.5	194.00	-0.37	-0.79	190.00	189.00	188.00	189.10	188.40	187.50
k5a0.5r0.7	182.00	-0.77	-1.25	177.00	175.00	175.00	175.80	174.80	174.50
k5a0.5r1.0	180.00	-0.62	-1.01	175.00	174.00	173.00	174.10	173.20	172.50
k5a0.7r0.1	220.00	-0.55	-0.66	217.00	216.00	216.00	216.40	215.80	215.50
k5a0.7r0.3	229.00	-0.59	-0.72	224.00	223.00	223.00	223.30	222.76	222.40
k5a0.7r0.5	222.00	-0.79	-0.94	217.00	216.00	216.00	215.94	215.80	215.50
k5a0.7r0.7	234.00	-0.83	-1.19	228.00	227.00	225.00	226.50	225.80	225.00
k5a0.7r1.0	229.00	-0.60	-1.12	222.00	221.00	219.00	220.60	219.60	218.00
k5a1.0r0.1	274.00	-0.22	-0.37	272.00	272.00	272.00	271.90	271.80	271.50
k5a1.0r0.3	285.00	-0.50	-0.89	281.00	280.00	280.00	280.18	279.60	279.00
k5a1.0r0.5	282.00	0.25	-0.10	280.00	280.00	279.00	279.80	279.60	279.00
k5a1.0r0.7	293.00	-0.25	-0.45	290.00	289.00	289.00	289.20	288.60	288.00
k5a1.0r1.0	286.00	-0.74	-0.92	280.00	280.00	280.00	279.90	279.80	279.50
k7a0.1r0.1	85.00	-1.92	-2.99	81.00	81.00	80.00	80.58	80.16	79.60
k7a0.1r0.3	91.00	-0.96	-3.94	87.00	85.00	81.00	84.02	82.04	80.20
k7a0.1r0.5	82.00	-1.79	-4.85	76.00	75.00	74.00	75.00	74.40	73.50

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Instance	BR-FF-VND		Sim BR-FF-VND (0.5)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%	
k7a0.1r0.7	77.00	-3.01	-5.96	68.00	67.00	66.00	66.90	66.20	66.00	
k7a0.1r1.0	73.00	-1.35	-3.41	67.00	66.00	63.00	65.10	64.00	62.50	
k7a0.3r0.1	170.00	-1.53	-3.12	162.00	161.00	159.00	160.50	159.60	159.00	
k7a0.3r0.3	187.00	-1.05	-1.64	180.00	179.00	177.00	178.58	177.56	176.20	
k7a0.3r0.5	165.00	-0.71	-1.84	159.00	157.00	156.00	157.20	156.20	155.50	
k7a0.3r0.7	170.00	-0.43	-1.05	167.00	163.00	161.00	163.90	161.60	160.50	
k7a0.3r1.0	154.00	-1.11	-1.82	147.00	144.00	141.00	144.00	142.00	140.50	
k7a0.5r0.1	248.00	-0.97	-1.11	240.00	239.00	237.00	238.60	237.80	236.50	
k7a0.5r0.3	256.00	-0.65	-0.74	250.00	249.00	247.00	248.58	247.64	246.70	
k7a0.5r0.5	233.00	-0.84	-1.36	227.00	227.00	225.00	226.40	225.80	224.50	
k7a0.5r0.7	245.00	-0.87	-1.23	239.00	238.00	236.00	237.30	236.40	234.50	
k7a0.5r1.0	257.00	-1.06	-1.30	249.00	249.00	246.00	248.10	247.20	245.00	
k7a0.7r0.1	283.00	-0.86	-1.11	277.00	275.00	274.00	275.20	273.80	272.50	
k7a0.7r0.3	307.00	-1.01	-1.27	299.00	297.00	297.00	297.30	296.80	296.50	
k7a0.7r0.5	307.00	0.15	-0.09	304.00	303.00	300.00	302.20	301.20	299.50	
k7a0.7r0.7	302.00	-0.62	-1.50	295.00	294.00	294.00	294.50	294.00	294.00	
k7a0.7r1.0	299.00	-0.85	-1.25	292.00	291.00	290.00	290.26	289.24	287.80	
k7a1.0r0.1	395.00	-0.19	-0.44	392.00	391.00	389.00	390.50	389.60	388.00	
k7a1.0r0.3	351.00	-0.11	-0.21	348.00	347.00	347.00	347.22	346.76	346.40	
k7a1.0r0.5	344.00	-0.37	-0.49	340.00	339.00	339.00	339.40	339.00	339.00	
k7a1.0r0.7	355.00	-0.52	-0.74	351.00	350.00	350.00	350.30	350.00	350.00	
k7a1.0r1.0	331.00	-0.25	-0.37	328.00	327.00	327.00	327.40	327.00	327.00	
k10a0.1r0.1	110.00	-2.14	-3.68	102.00	99.00	98.00	99.80	98.40	98.00	
k10a0.1r0.3	109.00	-2.00	-2.86	101.00	100.00	99.00	99.90	99.00	97.50	
k10a0.1r0.5	121.00	-2.04	-2.73	112.00	109.00	107.00	109.50	107.60	105.50	
k10a0.1r0.7	96.00	-2.48	-3.31	86.00	85.00	83.00	84.52	83.36	82.40	
k10a0.1r1.0	99.00	-1.61	-4.28	93.00	93.00	91.00	92.20	91.40	90.00	
k10a0.3r0.1	256.00	-1.19	-2.04	247.00	246.00	243.00	244.84	243.12	241.00	
k10a0.3r0.3	235.00	-0.35	-2.88	230.00	227.00	226.00	227.40	225.80	225.00	
k10a0.3r0.5	224.00	-1.04	-1.94	212.00	209.00	208.00	209.30	208.20	208.00	
k10a0.3r0.7	220.00	-1.05	-2.07	210.00	208.00	206.00	207.90	206.80	205.50	
k10a0.3r1.0	236.00	-1.33	-2.06	226.00	224.00	223.00	224.30	223.60	223.00	
k10a0.5r0.1	365.00	-0.48	-0.77	358.00	357.00	356.00	356.90	356.20	355.50	
k10a0.5r0.3	336.00	-0.86	-1.30	327.00	326.00	326.00	326.20	325.60	325.00	
k10a0.5r0.5	325.00	-1.04	-1.37	316.00	313.00	311.00	313.30	311.60	310.00	
k10a0.5r0.7	319.00	-0.52	-1.01	311.00	310.00	306.00	308.80	307.40	305.00	
k10a0.5r1.0	318.00	-0.98	-1.24	308.00	307.00	305.00	306.60	306.00	305.00	
k10a0.7r0.1	435.00	-0.68	-0.79	428.00	425.00	422.00	425.00	423.40	421.00	
k10a0.7r0.3	443.00	-0.70	-0.80	433.00	431.00	429.00	431.10	429.60	428.00	
k10a0.7r0.5	426.00	-0.75	-1.36	418.00	415.00	415.00	416.20	414.80	414.50	
k10a0.7r0.7	395.00	-0.98	-1.32	385.00	384.00	383.00	383.88	382.92	381.90	
k10a0.7r1.0	418.00	-0.92	-1.49	408.00	406.00	405.00	406.18	405.04	403.90	
k10a1.0r0.1	573.00	-0.47	-0.65	564.00	562.00	561.00	561.90	560.80	560.00	

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Instance	BR-FF-VND	Sim BR-FF-VND (0.5)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k10a1.0r0.3	517.00	-0.39	-0.51	512.00	510.00	506.00	509.40	507.60	505.00
k10a1.0r0.5	478.00	-0.50	-0.70	472.00	471.00	470.00	471.10	470.60	470.00
k10a1.0r0.7	531.00	-0.40	-0.57	522.00	518.00	515.00	518.00	515.80	514.00
k10a1.0r1.0	473.00	-0.56	-0.71	468.00	467.00	466.00	466.72	466.24	465.60
Average	167.28	-0.81	-1.53						

Table 1.6: Relative deviations for the Simheuristic best solutions (DevBest %) and average of best solutions (AvgDev %) with a level of uncertainty equal to 0.5 to the BR-FF-VND with 1 minute stop time criterion and the Value at Risk ($VaR\alpha$) and Conditional-Value-at-Risk ($CVaR\alpha$) with three levels of confidence (95%, 97.5% and 99%) of the Simheuristic best solution

Instance	BR-FF-VND	Sim BR-FF-VND (1.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k1a0.1r0.1	21.00	-1.93	-2.28	19.00	19.00	18.00	18.80	18.60	18.00
k1a0.1r0.3	22.00	-1.50	-1.78	21.00	21.00	20.00	20.60	20.20	20.00
k1a0.1r0.5	21.00	-2.60	-3.96	19.00	19.00	19.00	18.90	18.80	18.50
k1a0.1r0.7	17.00	-2.94	-3.29	15.00	15.00	15.00	15.00	15.00	15.00
k1a0.1r1.0	20.00	-2.15	-4.90	18.00	18.00	18.00	17.90	17.80	17.50
k1a0.3r0.1	46.00	-1.27	-2.20	43.00	43.00	42.00	42.80	42.60	42.00
k1a0.3r0.3	45.00	-0.51	-0.91	44.00	43.00	42.00	43.30	42.60	42.00
k1a0.3r0.5	46.00	-0.98	-1.38	44.00	44.00	43.00	43.80	43.60	43.00
k1a0.3r0.7	47.00	-0.98	-1.32	45.00	45.00	45.00	44.90	44.80	44.50
k1a0.3r1.0	44.00	-1.39	-2.32	41.00	41.00	41.00	41.00	41.00	41.00
k1a0.5r0.1	65.00	-0.66	-0.84	63.00	63.00	62.00	62.56	62.12	62.00
k1a0.5r0.3	63.00	-0.90	-1.10	62.00	61.00	60.00	60.80	60.20	60.00
k1a0.5r0.5	67.00	-0.13	-0.22	66.00	65.00	65.00	65.40	64.96	64.90
k1a0.5r0.7	66.00	-1.92	-2.46	63.00	63.00	63.00	62.92	62.84	62.60
k1a0.5r1.0	60.00	-1.54	-2.70	57.00	56.00	56.00	56.44	55.92	55.80
k1a0.7r0.1	81.00	-0.83	-1.55	79.00	79.00	78.00	78.80	78.60	78.00
k1a0.7r0.3	81.00	-0.52	-0.71	79.00	78.00	78.00	78.10	78.00	78.00
k1a0.7r0.5	80.00	-0.62	-0.82	78.00	77.00	77.00	77.20	77.00	77.00
k1a0.7r0.7	79.00	-0.73	-1.04	77.00	77.00	76.00	76.56	76.12	76.00
k1a0.7r1.0	79.00	-0.92	-1.28	77.00	77.00	76.00	76.70	76.40	76.00
k1a1.0r0.1	99.00	-0.17	-0.24	98.00	98.00	97.00	97.70	97.40	97.00
k1a1.0r0.3	99.00	-0.49	-0.61	97.00	97.00	97.00	96.90	96.80	96.50
k1a1.0r0.5	99.00	-0.05	-0.41	98.00	98.00	97.00	97.70	97.40	97.00
k1a1.0r0.7	98.00	-0.33	-0.60	96.00	96.00	96.00	96.00	96.00	96.00
k1a1.0r1.0	97.00	-0.39	-0.61	95.00	95.00	94.00	94.60	94.20	94.00

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Instance	BR-FF-VND			Sim BR-FF-VND (1.0)			VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%			
k2a0.1r0.1	29.00	-2.51	-6.18	27.00	26.00	25.00	25.68	25.24	25.00			
k2a0.1r0.3	30.00	-3.23	-3.73	27.00	27.00	25.00	26.60	26.20	25.00			
k2a0.1r0.5	28.00	-2.87	-5.01	25.00	25.00	25.00	24.90	24.80	24.50			
k2a0.1r0.7	30.00	-3.58	-4.97	26.00	26.00	25.00	25.60	25.20	24.50			
k2a0.1r1.0	27.00	-4.74	-7.51	23.00	23.00	23.00	22.90	22.80	22.50			
k2a0.3r0.1	71.00	-0.62	-0.88	68.00	68.00	67.00	67.60	67.20	67.00			
k2a0.3r0.3	68.00	-1.60	-2.01	65.00	64.00	64.00	64.20	63.80	63.50			
k2a0.3r0.5	62.00	-1.39	-1.81	58.00	58.00	58.00	57.90	57.80	57.50			
k2a0.3r0.7	71.00	-1.58	-2.54	67.00	67.00	66.00	66.70	66.40	66.00			
k2a0.3r1.0	64.00	-2.10	-2.65	60.00	59.00	59.00	59.40	59.00	59.00			
k2a0.5r0.1	100.00	-0.37	-0.56	98.00	97.00	96.00	96.90	96.20	95.50			
k2a0.5r0.3	98.00	-0.53	-1.04	95.00	94.00	94.00	94.10	93.68	93.20			
k2a0.5r0.5	99.00	-1.36	-2.02	95.00	94.00	94.00	94.18	93.88	93.70			
k2a0.5r0.7	94.00	-2.09	-2.27	90.00	90.00	89.00	89.60	89.20	89.00			
k2a0.5r1.0	86.00	-0.41	-1.46	84.00	83.00	82.00	83.00	82.20	81.50			
k2a0.7r0.1	118.00	-1.13	-1.27	115.00	114.00	113.00	113.80	113.52	112.90			
k2a0.7r0.3	115.00	-0.87	-0.99	111.00	111.00	110.00	110.80	110.60	110.00			
k2a0.7r0.5	114.00	-0.80	-1.02	111.00	109.00	108.00	109.40	108.40	108.00			
k2a0.7r0.7	118.00	-0.70	-1.14	114.00	114.00	113.00	113.80	113.60	113.00			
k2a0.7r1.0	111.00	-1.50	-1.79	106.00	104.00	104.00	104.80	104.00	104.00			
k2a1.0r0.1	151.00	-0.27	-0.32	149.00	148.00	148.00	148.44	147.96	147.90			
k2a1.0r0.3	150.00	-0.23	-0.37	148.00	147.00	147.00	147.50	147.00	147.00			
k2a1.0r0.5	154.00	-0.58	-0.70	150.00	150.00	150.00	149.90	149.80	149.50			
k2a1.0r0.7	150.00	-0.21	-0.32	148.00	148.00	147.00	147.70	147.40	146.50			
k2a1.0r1.0	142.00	-1.18	-1.44	138.00	138.00	136.00	137.50	137.00	136.00			
k3a0.1r0.1	39.00	-1.53	-1.92	36.00	36.00	35.00	35.70	35.40	35.00			
k3a0.1r0.3	33.00	-4.86	-8.03	29.00	29.00	27.00	28.40	27.80	27.00			
k3a0.1r0.5	38.00	-5.34	-6.75	33.00	33.00	32.00	32.22	31.44	30.50			
k3a0.1r0.7	38.00	0.09	-2.21	36.00	34.00	34.00	34.60	34.00	34.00			
k3a0.1r1.0	36.00	-3.82	-6.07	31.00	30.00	29.00	29.92	29.32	29.00			
k3a0.3r0.1	91.00	-1.75	-2.14	86.00	86.00	86.00	86.00	86.00	86.00			
k3a0.3r0.3	92.00	-1.91	-2.17	87.00	87.00	86.00	86.50	86.00	85.50			
k3a0.3r0.5	85.00	-1.82	-2.79	81.00	81.00	80.00	80.70	80.40	80.00			
k3a0.3r0.7	90.00	-1.97	-2.24	85.00	84.00	84.00	84.20	84.00	84.00			
k3a0.3r1.0	87.00	-2.01	-2.60	81.00	81.00	80.00	80.70	80.40	79.50			
k3a0.5r0.1	128.00	-1.04	-1.40	124.00	123.00	122.00	122.82	122.12	121.40			
k3a0.5r0.3	129.00	-1.13	-1.35	125.00	125.00	124.00	124.22	123.44	122.50			
k3a0.5r0.5	126.00	-1.56	-1.84	121.00	120.00	120.00	120.10	119.60	119.00			
k3a0.5r0.7	128.00	-1.18	-1.25	123.00	123.00	122.00	122.70	122.40	122.00			
k3a0.5r1.0	120.00	-1.88	-2.35	114.00	114.00	113.00	113.22	112.44	111.20			
k3a0.7r0.1	168.00	-0.65	-0.84	164.00	164.00	163.00	163.60	163.20	163.00			
k3a0.7r0.3	161.00	-0.96	-1.13	157.00	156.00	155.00	155.62	155.08	154.10			
k3a0.7r0.5	157.00	-1.21	-1.42	152.00	152.00	151.00	151.60	151.20	151.00			

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Instance	BR-FF-VND			VaR α			CVaR α		
	BestSol	Sim BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k3a0.7r0.7	160.00	-0.67	-1.09	156.00	155.00	154.00	155.18	154.52	153.80
k3a0.7r1.0	157.00	-0.57	-1.42	151.00	150.00	150.00	150.14	149.64	149.10
k3a1.0r0.1	194.00	-0.51	-0.63	191.00	190.00	190.00	190.30	189.72	189.30
k3a1.0r0.3	168.00	-0.19	-0.30	167.00	167.00	167.00	167.00	167.00	167.00
k3a1.0r0.5	202.00	-0.70	-0.91	198.00	197.00	196.00	197.30	196.60	196.00
k3a1.0r0.7	193.00	-0.90	-1.11	188.00	188.00	188.00	187.90	187.80	187.50
k3a1.0r1.0	183.00	-0.61	-1.01	178.00	177.00	176.00	176.88	176.28	175.20
k5a0.1r0.1	54.00	-1.36	-4.69	50.00	48.00	46.00	48.10	47.00	46.00
k5a0.1r0.3	58.00	-3.65	-4.06	51.00	50.00	49.00	49.80	49.20	48.50
k5a0.1r0.5	69.00	-3.52	-5.08	62.00	60.00	60.00	60.40	59.40	58.50
k5a0.1r0.7	61.00	-3.79	-7.46	54.00	52.00	50.00	51.70	50.20	49.00
k5a0.1r1.0	58.00	-3.82	-9.49	51.00	49.00	49.00	49.90	49.00	49.00
k5a0.3r0.1	144.00	-1.46	-2.54	137.00	137.00	135.00	136.10	135.20	133.60
k5a0.3r0.3	129.00	-2.07	-2.42	121.00	120.00	119.00	120.20	119.60	119.00
k5a0.3r0.5	126.00	-1.25	-2.07	120.00	119.00	117.00	118.46	117.24	115.90
k5a0.3r0.7	123.00	-1.61	-4.17	117.00	116.00	115.00	115.90	115.00	113.50
k5a0.3r1.0	131.00	-1.68	-2.17	123.00	122.00	121.00	121.70	121.20	121.00
k5a0.5r0.1	190.00	-1.18	-1.42	183.00	182.00	180.00	181.60	180.80	179.50
k5a0.5r0.3	186.00	-1.00	-1.20	180.00	179.00	177.00	179.00	178.00	176.50
k5a0.5r0.5	194.00	-0.93	-1.29	187.00	186.00	185.00	186.10	185.20	184.50
k5a0.5r0.7	182.00	-1.66	-2.04	175.00	174.00	173.00	173.70	173.08	172.30
k5a0.5r1.0	180.00	-1.32	-1.74	172.00	171.00	171.00	171.00	170.40	169.50
k5a0.7r0.1	220.00	-0.89	-1.02	215.00	214.00	213.00	213.98	213.24	212.30
k5a0.7r0.3	229.00	-1.14	-1.24	223.00	222.00	220.00	221.60	220.80	219.50
k5a0.7r0.5	222.00	-1.30	-1.46	215.00	214.00	213.00	213.90	213.00	212.00
k5a0.7r0.7	234.00	-1.45	-1.71	225.00	225.00	224.00	224.70	224.40	223.50
k5a0.7r1.0	229.00	-1.42	-1.89	219.00	218.00	216.00	218.00	217.00	216.00
k5a1.0r0.1	274.00	-0.35	-0.52	271.00	270.00	269.00	270.30	269.60	269.00
k5a1.0r0.3	285.00	-0.87	-1.15	279.00	278.00	277.00	278.04	277.08	275.80
k5a1.0r0.5	282.00	0.00	-0.30	279.00	278.00	278.00	278.20	278.00	278.00
k5a1.0r0.7	293.00	-0.61	-0.88	287.00	286.00	284.00	286.00	285.00	284.00
k5a1.0r1.0	286.00	-1.19	-1.38	278.00	277.00	275.00	276.80	275.80	274.50
k7a0.1r0.1	85.00	-2.52	-4.36	80.00	79.00	78.00	78.48	77.52	76.50
k7a0.1r0.3	91.00	-2.27	-4.71	82.00	79.00	77.00	79.00	77.40	76.50
k7a0.1r0.5	82.00	-3.24	-6.00	73.00	72.00	71.00	71.70	71.20	70.50
k7a0.1r0.7	77.00	-5.23	-7.69	65.00	65.00	64.00	64.50	64.00	63.00
k7a0.1r1.0	73.00	-3.07	-4.67	63.00	62.00	61.00	62.20	61.40	61.00
k7a0.3r0.1	170.00	-2.51	-3.98	159.00	157.00	155.00	156.90	155.20	154.00
k7a0.3r0.3	187.00	-2.07	-2.59	176.00	175.00	173.00	174.22	173.16	171.40
k7a0.3r0.5	165.00	-1.77	-2.86	154.00	153.00	148.00	151.80	150.20	148.00
k7a0.3r0.7	171.00	-1.87	-2.62	160.00	158.00	157.00	158.00	156.60	155.00
k7a0.3r1.0	154.00	-2.18	-2.92	142.00	140.00	137.00	139.90	138.20	136.50
k7a0.5r0.1	247.00	-1.30	-1.43	237.00	234.00	234.00	234.80	233.80	233.50

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Instance	BR-FF-VND			VaR α			CVaR α		
	BestSol	Sim BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k7a0.5r0.3	256.00	-1.20	-1.39	247.00	245.00	243.00	245.00	243.80	242.50
k7a0.5r0.5	233.00	-1.39	-1.93	224.00	223.00	222.00	222.90	222.00	220.50
k7a0.5r0.7	245.00	-1.60	-1.92	234.00	233.00	228.00	232.20	230.60	227.50
k7a0.5r1.0	257.00	-1.85	-2.12	245.00	244.00	243.00	243.90	243.20	242.50
k7a0.7r0.1	283.00	-1.38	-1.53	275.00	273.00	268.00	272.00	269.80	266.50
k7a0.7r0.3	307.00	-1.71	-1.84	295.00	294.00	293.00	293.90	292.80	291.00
k7a0.7r0.5	307.00	-0.36	-0.68	299.00	297.00	292.00	296.10	294.00	291.50
k7a0.7r0.7	302.00	-1.11	-2.02	293.00	293.00	291.00	292.20	291.40	290.50
k7a0.7r1.0	299.00	-1.55	-1.80	287.00	285.00	283.00	284.60	283.00	281.00
k7a1.0r0.1	395.00	-0.49	-0.74	387.00	386.00	384.00	385.80	384.60	383.50
k7a1.0r0.3	351.00	-0.27	-0.40	347.00	347.00	345.00	346.40	345.80	345.00
k7a1.0r0.5	344.00	-0.64	-0.79	338.00	338.00	337.00	337.60	337.20	337.00
k7a1.0r0.7	355.00	-0.77	-1.04	349.00	348.00	346.00	348.00	347.00	346.00
k7a1.0r1.0	331.00	-0.53	-0.62	326.00	325.00	325.00	325.34	324.68	324.20
k10a0.1r0.1	110.00	-3.71	-5.15	98.00	96.00	95.00	96.18	94.88	93.80
k10a0.1r0.3	109.00	-3.54	-4.61	97.00	96.00	93.00	95.30	93.80	91.50
k10a0.1r0.5	121.00	-3.52	-4.34	109.00	107.00	103.00	106.10	104.20	102.00
k10a0.1r0.7	96.00	-3.81	-4.45	87.00	85.00	84.00	85.40	84.20	84.00
k10a0.1r1.0	99.00	-2.67	-5.39	91.00	88.00	88.00	88.80	87.80	87.50
k10a0.3r0.1	256.00	-2.17	-2.92	241.00	239.00	235.00	238.10	235.76	233.30
k10a0.3r0.3	235.00	-1.14	-3.79	225.00	221.00	218.00	221.40	219.20	217.50
k10a0.3r0.5	224.00	-2.37	-2.90	208.00	205.00	203.00	205.00	203.20	202.50
k10a0.3r0.7	220.00	-2.17	-3.13	206.00	203.00	201.00	203.30	201.80	201.00
k10a0.3r1.0	236.00	-2.57	-3.26	219.00	216.00	214.00	216.50	214.80	213.50
k10a0.5r0.1	365.00	-1.04	-1.35	354.00	352.00	350.00	352.20	351.00	350.00
k10a0.5r0.3	336.00	-1.47	-1.91	324.00	322.00	321.00	322.30	321.00	320.00
k10a0.5r0.5	325.00	-1.70	-2.13	311.00	305.00	303.00	306.10	303.40	302.00
k10a0.5r0.7	319.00	-1.20	-1.83	305.00	303.00	302.00	303.30	302.20	302.00
k10a0.5r1.0	318.00	-1.82	-2.09	302.00	300.00	299.00	300.30	299.40	298.50
k10a0.7r0.1	435.00	-1.11	-1.29	422.00	421.00	419.00	420.30	419.40	418.50
k10a0.7r0.3	443.00	-1.25	-1.35	428.00	426.00	423.00	425.50	424.00	422.50
k10a0.7r0.5	426.00	-1.31	-1.92	412.00	410.00	407.00	409.90	408.00	406.50
k10a0.7r0.7	395.00	-1.58	-1.94	381.00	379.00	376.00	378.12	376.36	374.50
k10a0.7r1.0	418.00	-1.64	-2.14	402.00	399.00	397.00	398.92	397.16	395.30
k10a1.0r0.1	573.00	-0.86	-1.01	559.00	557.00	553.00	555.90	553.40	551.50
k10a1.0r0.3	517.00	-0.62	-0.73	509.00	507.00	504.00	506.80	505.20	503.50
k10a1.0r0.5	478.00	-0.88	-1.05	468.00	466.00	465.00	465.94	464.84	463.60
k10a1.0r0.7	531.00	-0.86	-0.99	516.00	514.00	509.00	512.90	511.00	509.00
k10a1.0r1.0	473.00	-0.81	-0.99	465.00	464.00	463.00	463.54	462.56	461.20
Average	167.26	-1.53	-2.25						

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Instance	BR-FF-VND		Sim BR-FF-VND (1.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)		95%	97.5%	99%	95%	97.5%	99%

Table 1.7: Relative deviations for the Simheuristic best solutions (DevBest %) and average of best solutions (AvgDev %) with a level of uncertainty equal to 1.0 to the BR-FF-VND with 1 minute stop time criterion and the Value at Risk ($VaR\alpha$) and Conditional-Value-at-Risk (CVaR α) with three levels of confidence (95%, 97.5% and 99%) of the Simheuristic best solution

Instance	BR-FF-VND		Sim BR-FF-VND (2.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)		95%	97.5%	99%	95%	97.5%	99%
k1a0.1r0.1	21.00	-3.00	-3.43		19.00	18.00	18.00	18.50	18.00	18.00
k1a0.1r0.3	22.00	-2.57	-2.95		20.00	20.00	20.00	19.90	19.80	19.50
k1a0.1r0.5	21.00	-4.48	-5.57		19.00	18.00	18.00	18.20	17.80	17.50
k1a0.1r0.7	17.00	-4.50	-4.91		15.00	14.00	14.00	14.30	13.80	13.50
k1a0.1r1.0	20.00	-3.85	-6.98		17.00	17.00	16.00	16.70	16.40	16.00
k1a0.3r0.1	46.00	-2.11	-3.02		43.00	42.00	41.00	42.00	41.60	41.00
k1a0.3r0.3	45.00	-1.38	-1.77		42.00	42.00	42.00	41.88	41.76	41.40
k1a0.3r0.5	46.00	-1.75	-2.31		43.00	43.00	42.00	42.80	42.60	42.00
k1a0.3r0.7	47.00	-1.83	-2.15		44.00	44.00	44.00	43.90	43.80	43.50
k1a0.3r1.0	44.00	-3.08	-3.79		41.00	41.00	39.00	40.18	39.36	37.90
k1a0.5r0.1	65.00	-1.20	-1.38		62.00	62.00	61.00	61.66	61.32	60.70
k1a0.5r0.3	63.00	-1.40	-1.66		60.00	60.00	60.00	59.90	59.80	59.50
k1a0.5r0.5	67.00	-0.53	-0.69		65.00	65.00	64.00	64.70	64.40	63.50
k1a0.5r0.7	66.00	-2.57	-3.14		63.00	63.00	62.00	62.70	62.40	62.00
k1a0.5r1.0	60.00	-2.85	-3.96		56.00	55.00	54.00	55.00	54.40	53.50
k1a0.7r0.1	81.00	-1.46	-2.08		77.00	77.00	77.00	76.90	76.80	76.50
k1a0.7r0.3	81.00	-1.06	-1.25		78.00	78.00	77.00	77.70	77.40	76.50
k1a0.7r0.5	80.00	-1.25	-1.41		78.00	77.00	76.00	76.66	76.24	75.80
k1a0.7r0.7	79.00	-1.34	-1.68		76.00	76.00	76.00	75.80	75.60	75.00
k1a0.7r1.0	79.00	-1.46	-1.97		76.00	75.00	74.00	74.90	74.40	74.00
k1a1.0r0.1	99.00	-0.52	-0.57		97.00	97.00	96.00	96.70	96.40	96.00
k1a1.0r0.3	99.00	-0.88	-1.02		96.00	96.00	95.00	95.80	95.60	95.00
k1a1.0r0.5	99.00	-0.33	-0.70		97.00	97.00	96.00	96.70	96.40	96.00
k1a1.0r0.7	98.00	-0.56	-0.87		96.00	96.00	96.00	95.90	95.80	95.50
k1a1.0r1.0	97.00	-1.00	-1.18		94.00	93.00	92.00	93.12	92.24	91.10
k2a0.1r0.1	29.00	-3.88	-7.28		25.00	25.00	23.00	24.40	23.80	23.00
k2a0.1r0.3	30.00	-4.45	-4.98		27.00	26.00	25.00	25.60	25.00	24.00
k2a0.1r0.5	28.00	-4.68	-7.35		24.00	23.00	21.00	22.60	21.60	20.50
k2a0.1r0.7	30.00	-5.93	-7.27		24.00	22.00	21.00	22.50	21.60	21.00
k2a0.1r1.0	27.00	-6.43	-10.16		23.00	22.00	21.00	22.00	21.20	21.00

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Instance	BR-FF-VND			Sim BR-FF-VND (2.0)			VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%			
k2a0.3r0.1	71.00	-1.39	-1.62	68.00	67.00	66.00	66.80	66.20	66.00			
k2a0.3r0.3	68.00	-2.42	-2.93	64.00	64.00	63.00	63.70	63.40	62.50			
k2a0.3r0.5	62.00	-2.23	-2.97	58.00	58.00	56.00	57.50	57.00	56.00			
k2a0.3r0.7	71.00	-2.44	-3.53	66.00	65.00	64.00	65.30	64.60	64.00			
k2a0.3r1.0	64.00	-3.13	-3.99	59.00	57.00	56.00	57.30	56.40	55.50			
k2a0.5r0.1	100.00	-0.86	-1.00	96.00	95.00	95.00	95.28	94.88	94.70			
k2a0.5r0.3	98.00	-1.25	-1.74	93.00	93.00	92.00	92.40	91.80	91.40			
k2a0.5r0.5	99.00	-2.21	-2.73	93.00	92.00	91.00	91.92	91.16	90.30			
k2a0.5r0.7	94.00	-2.89	-3.13	88.00	87.00	86.00	87.00	86.20	86.00			
k2a0.5r1.0	86.00	-1.36	-2.37	82.00	80.00	80.00	80.50	79.80	79.50			
k2a0.7r0.1	118.00	-1.70	-1.82	113.00	112.00	111.00	112.30	111.60	111.00			
k2a0.7r0.3	115.00	-1.51	-1.62	110.00	109.00	108.00	109.30	108.60	108.00			
k2a0.7r0.5	114.00	-1.40	-1.64	110.00	109.00	108.00	109.10	108.40	107.50			
k2a0.7r0.7	118.00	-1.34	-1.70	113.00	113.00	112.00	112.64	112.28	111.40			
k2a0.7r1.0	111.00	-2.66	-2.84	104.00	103.00	102.00	102.90	102.40	102.00			
k2a1.0r0.1	151.00	-0.41	-0.45	148.00	147.00	145.00	146.80	146.00	145.00			
k2a1.0r0.3	150.00	-0.41	-0.55	147.00	147.00	146.00	146.60	146.20	145.50			
k2a1.0r0.5	154.00	-0.95	-1.08	150.00	149.00	148.00	149.10	148.40	148.00			
k2a1.0r0.7	150.00	-0.65	-0.74	147.00	147.00	146.00	146.40	145.80	145.00			
k2a1.0r1.0	142.00	-1.76	-2.02	136.00	135.00	134.00	135.20	134.60	134.00			
k3a0.1r0.1	39.00	-3.01	-3.46	35.00	34.00	32.00	34.00	33.00	31.50			
k3a0.1r0.3	33.00	-7.08	-10.00	27.00	26.00	25.00	26.06	25.20	24.00			
k3a0.1r0.5	38.00	-7.36	-8.47	30.00	29.00	28.00	29.20	28.40	28.00			
k3a0.1r0.7	38.00	-1.93	-4.01	33.00	32.00	31.00	32.00	31.40	31.00			
k3a0.1r1.0	36.00	-6.28	-8.34	29.00	29.00	28.00	28.40	27.80	27.20			
k3a0.3r0.1	91.00	-2.73	-3.21	84.00	83.00	82.00	83.14	82.44	81.90			
k3a0.3r0.3	92.00	-2.76	-3.08	86.00	85.00	84.00	85.00	84.20	83.50			
k3a0.3r0.5	85.00	-2.91	-3.75	78.00	77.00	76.00	77.30	76.60	76.00			
k3a0.3r0.7	90.00	-3.09	-3.44	84.00	83.00	81.00	82.50	81.40	80.50			
k3a0.3r1.0	87.00	-3.29	-3.94	79.00	78.00	76.00	77.70	76.40	75.50			
k3a0.5r0.1	128.00	-1.72	-2.15	121.00	121.00	120.00	120.60	120.20	120.00			
k3a0.5r0.3	129.00	-1.94	-2.15	124.00	123.00	122.00	122.80	122.20	121.50			
k3a0.5r0.5	126.00	-2.44	-2.73	119.00	118.00	118.00	118.10	117.60	117.00			
k3a0.5r0.7	128.00	-1.97	-2.14	122.00	121.00	120.00	121.10	120.20	119.00			
k3a0.5r1.0	120.00	-3.17	-3.57	111.00	110.00	109.00	109.78	108.88	107.80			
k3a0.7r0.1	168.00	-1.23	-1.35	162.00	161.00	160.00	160.90	160.00	159.00			
k3a0.7r0.3	161.00	-1.58	-1.76	155.00	154.00	153.00	154.10	153.40	152.50			
k3a0.7r0.5	156.00	-1.25	-1.48	150.00	150.00	148.00	149.00	148.00	147.00			
k3a0.7r0.7	160.00	-1.33	-1.84	155.00	154.00	153.00	153.64	152.52	150.80			
k3a0.7r1.0	157.00	-1.32	-2.13	149.00	147.00	147.00	147.16	146.28	145.20			
k3a1.0r0.1	194.00	-0.88	-1.00	190.00	189.00	188.00	188.90	188.60	188.00			
k3a1.0r0.3	168.00	-0.28	-0.45	167.00	167.00	165.00	166.40	165.80	165.00			
k3a1.0r0.5	202.00	-1.19	-1.33	197.00	196.00	195.00	195.64	195.00	194.10			

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Instance	BR-FF-VND			Sim BR-FF-VND (2.0)			VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%			
k3a1.0r0.7	193.00	-1.32	-1.49	188.00	188.00	188.00	187.80	187.60	187.00			
k3a1.0r1.0	184.00	-1.87	-2.27	176.00	175.00	173.00	174.30	173.00	170.50			
k5a0.1r0.1	54.00	-3.36	-6.51	47.00	44.00	42.00	44.40	42.60	42.00			
k5a0.1r0.3	58.00	-6.08	-6.68	48.00	47.00	46.00	47.10	46.40	46.00			
k5a0.1r0.5	69.00	-5.78	-7.40	58.00	56.00	54.00	55.70	54.80	54.00			
k5a0.1r0.7	61.00	-6.05	-9.51	50.00	49.00	46.00	48.50	47.20	45.00			
k5a0.1r1.0	58.00	-6.03	-11.75	49.00	47.00	46.00	46.80	45.80	45.00			
k5a0.3r0.1	144.00	-2.38	-3.53	135.00	133.00	131.00	132.52	130.84	128.80			
k5a0.3r0.3	129.00	-3.38	-3.72	119.00	117.00	116.00	117.00	115.80	114.50			
k5a0.3r0.5	126.00	-2.40	-3.20	116.00	113.00	109.00	112.62	110.28	108.10			
k5a0.3r0.7	123.00	-2.78	-5.59	114.00	112.00	109.00	111.30	109.00	107.00			
k5a0.3r1.0	131.00	-2.99	-3.57	121.00	120.00	117.00	119.60	118.20	116.00			
k5a0.5r0.1	190.00	-1.84	-2.22	181.00	179.00	176.00	178.90	177.40	176.00			
k5a0.5r0.3	186.00	-1.76	-1.97	177.00	175.00	174.00	175.20	174.00	172.50			
k5a0.5r0.5	194.00	-1.72	-2.06	184.00	183.00	182.00	182.60	181.60	180.00			
k5a0.5r0.7	182.00	-2.62	-3.07	172.00	171.00	170.00	170.20	168.60	166.00			
k5a0.5r1.0	181.00	-2.76	-3.29	169.00	167.00	165.00	166.70	164.80	162.50			
k5a0.7r0.1	220.00	-1.39	-1.56	212.00	210.00	209.00	210.40	209.00	208.00			
k5a0.7r0.3	229.00	-1.54	-1.88	220.00	219.00	217.00	218.60	217.80	217.00			
k5a0.7r0.5	222.00	-2.00	-2.15	212.00	210.00	209.00	210.40	209.00	208.50			
k5a0.7r0.7	234.00	-2.10	-2.36	224.00	222.00	220.00	221.80	220.20	218.50			
k5a0.7r1.0	229.00	-2.39	-3.01	216.00	213.00	209.00	212.90	210.80	208.50			
k5a1.0r0.1	273.00	-0.24	-0.45	269.00	268.00	268.00	268.20	267.80	267.50			
k5a1.0r0.3	285.00	-1.38	-1.57	276.00	275.00	273.00	274.22	273.12	271.60			
k5a1.0r0.5	282.00	-0.32	-0.61	277.00	275.00	273.00	274.56	273.36	271.90			
k5a1.0r0.7	293.00	-1.29	-1.58	283.00	281.00	278.00	280.60	279.20	277.50			
k5a1.0r1.0	286.00	-1.83	-2.04	274.00	272.00	270.00	271.80	270.40	269.50			
k7a0.1r0.1	85.00	-3.42	-6.33	76.00	73.00	72.00	73.30	71.60	70.50			
k7a0.1r0.3	91.00	-4.44	-7.28	78.00	75.00	72.00	74.58	72.24	69.90			
k7a0.1r0.5	82.00	-5.35	-7.57	70.00	69.00	68.00	68.60	67.80	67.00			
k7a0.1r0.7	77.00	-7.66	-9.85	61.00	60.00	59.00	59.80	58.80	58.00			
k7a0.1r1.0	73.00	-5.02	-6.82	61.00	61.00	60.00	60.70	60.40	60.00			
k7a0.3r0.1	170.00	-3.84	-5.26	155.00	152.00	149.00	152.10	150.20	148.50			
k7a0.3r0.3	187.00	-3.46	-3.84	172.00	169.00	166.00	168.30	166.28	164.20			
k7a0.3r0.5	165.00	-3.33	-4.28	148.00	148.00	147.00	147.30	146.60	145.50			
k7a0.3r0.7	170.00	-2.75	-3.76	155.00	152.00	149.00	152.20	150.20	148.00			
k7a0.3r1.0	154.00	-3.50	-4.32	139.00	137.00	131.00	136.00	134.00	131.00			
k7a0.5r0.1	247.00	-2.20	-2.37	233.00	232.00	231.00	232.10	231.40	230.50			
k7a0.5r0.3	256.00	-2.17	-2.34	242.00	238.00	236.00	238.50	236.60	235.50			
k7a0.5r0.5	233.00	-2.39	-2.91	220.00	218.00	216.00	217.70	215.60	212.00			
k7a0.5r0.7	245.00	-2.58	-2.99	231.00	227.00	223.00	226.10	222.80	218.00			
k7a0.5r1.0	257.00	-2.79	-3.27	240.00	238.00	236.00	237.80	236.60	235.00			
k7a0.7r0.1	283.00	-1.94	-2.16	270.00	268.00	262.00	266.90	264.40	260.50			

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Instance	BR-FF-VND	Sim BR-FF-VND (2.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k7a0.7r0.3	307.00	-2.47	-2.61	290.00	289.00	287.00	288.20	286.80	284.50
k7a0.7r0.5	307.00	-1.22	-1.50	293.00	291.00	286.00	289.40	286.80	283.50
k7a0.7r0.7	302.00	-1.94	-2.73	286.00	285.00	283.00	284.20	283.20	282.00
k7a0.7r1.0	299.00	-2.11	-2.43	285.00	284.00	280.00	283.10	281.60	278.00
k7a1.0r0.1	395.00	-0.91	-1.17	385.00	384.00	381.00	383.50	382.00	381.00
k7a1.0r0.3	351.00	-0.52	-0.64	345.00	345.00	344.00	344.70	344.40	344.00
k7a1.0r0.5	344.00	-1.06	-1.23	336.00	335.00	334.00	335.00	334.40	334.00
k7a1.0r0.7	355.00	-1.14	-1.44	345.00	344.00	342.00	343.78	342.76	341.40
k7a1.0r1.0	331.00	-0.86	-0.99	325.00	324.00	323.00	323.90	323.00	322.50
k10a0.1r0.1	110.00	-5.68	-6.93	94.00	91.00	88.00	90.40	88.32	85.90
k10a0.1r0.3	109.00	-5.44	-6.68	92.00	89.00	87.00	89.60	87.60	86.50
k10a0.1r0.5	121.00	-5.54	-6.33	104.00	102.00	95.00	100.20	97.20	93.00
k10a0.1r0.7	96.00	-5.50	-6.13	83.00	80.00	78.00	80.50	78.60	78.00
k10a0.1r1.0	99.00	-4.24	-6.93	87.00	85.00	82.00	84.50	82.80	81.00
k10a0.3r0.1	256.00	-3.41	-4.21	235.00	229.00	227.00	230.60	227.60	226.00
k10a0.3r0.3	235.00	-2.52	-5.16	217.00	216.00	207.00	213.40	210.40	206.50
k10a0.3r0.5	224.00	-3.93	-4.52	201.00	198.00	198.00	199.10	197.80	197.50
k10a0.3r0.7	220.00	-3.74	-4.62	198.00	195.00	194.00	195.50	194.20	193.50
k10a0.3r1.0	236.00	-4.49	-4.92	210.00	208.00	205.00	207.60	205.80	204.00
k10a0.5r0.1	365.00	-1.98	-2.19	349.00	346.00	343.00	345.70	343.80	341.50
k10a0.5r0.3	336.00	-2.26	-2.79	316.00	312.00	309.00	312.90	310.80	309.00
k10a0.5r0.5	325.00	-2.80	-3.17	302.00	297.00	294.00	297.50	294.40	293.50
k10a0.5r0.7	319.00	-2.36	-3.03	298.00	295.00	294.00	295.60	294.20	294.00
k10a0.5r1.0	318.00	-3.02	-3.28	298.00	287.00	284.00	290.30	285.00	282.00
k10a0.7r0.1	435.00	-1.83	-1.99	416.00	413.00	409.00	412.50	409.80	408.00
k10a0.7r0.3	443.00	-2.04	-2.12	422.00	418.00	412.00	416.72	412.68	408.60
k10a0.7r0.5	426.00	-2.16	-2.77	406.00	402.00	396.00	401.30	398.40	395.00
k10a0.7r0.7	395.00	-2.43	-2.78	374.00	369.00	361.00	368.30	364.20	360.50
k10a0.7r1.0	416.00	-2.26	-2.63	395.00	390.00	386.00	390.60	387.40	386.00
k10a1.0r0.1	573.00	-1.41	-1.56	553.00	549.00	546.00	548.72	545.96	542.70
k10a1.0r0.3	517.00	-0.94	-1.04	506.00	505.00	498.00	503.20	500.60	497.00
k10a1.0r0.5	478.00	-1.32	-1.55	463.00	461.00	458.00	460.80	459.00	457.50
k10a1.0r0.7	530.00	-1.31	-1.42	511.00	509.00	505.00	507.90	506.00	504.50
k10a1.0r1.0	473.00	-1.21	-1.37	461.00	460.00	459.00	459.40	458.20	456.50
Average	167.23	-2.52	-3.26						

Table 1.8: Relative deviations for the Simheuristic best solutions (DevBest %) and average of best solutions (AvgDev %) with a level of uncertainty equal to 2.0 to the BR-FF-VND with 1 minute stop time criterion and the Value at Risk ($VaR\alpha$) and Conditional-Value-at-Risk ($CVaR\alpha$) with three levels of confidence (95%, 97.5% and 99%) of the Simheuristic best solution

1.2.2

Permutation flow shop problem with delivery dates. cumulative payoff and stochastic times and release dates - PFSPSTRD

On this Section the results aforementioned on Table 5.5 and 5.6 are illustrated. Each Table contains the 150 instances mentioned in Section ???. For each instance. the best solution provided by BR-FF-VND metaheuristic and their deviation with proposed Sim BR-FF-VND were shown. Moreover. the Value at Risk (VaR_α) and Conditional Value at Risk ($CVaR_\alpha$) of the best stochastic solution were illustrated with for three different levels of confidence.

Instance	BR-FF-VND		Sim BR-FF-VND (2.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%	
k1a0.1r0.1	21.00	-0.02	-0.63	21.00	21.00	21.00	20.90	20.80	20.50	
k1a0.1r0.3	22.00	0.00	-0.04	22.00	22.00	22.00	22.00	22.00	22.00	
k1a0.1r0.5	21.00	-0.18	-0.43	21.00	20.00	20.00	20.26	19.96	19.90	
k1a0.1r0.7	17.00	-0.05	-0.52	17.00	17.00	17.00	16.84	16.68	16.20	
k1a0.1r1.0	20.00	-0.18	-1.10	20.00	19.00	19.00	19.30	19.00	19.00	
k1a0.3r0.1	46.00	-0.03	-0.54	46.00	46.00	45.00	45.68	45.36	44.90	
k1a0.3r0.3	45.00	1.27	0.43	45.00	44.00	44.00	44.38	44.00	44.00	
k1a0.3r0.5	46.00	0.00	-0.01	46.00	46.00	46.00	46.00	46.00	46.00	
k1a0.3r0.7	47.00	-0.02	-0.07	47.00	47.00	47.00	46.84	46.68	46.20	
k1a0.3r1.0	44.00	0.00	-0.49	44.00	44.00	44.00	44.00	44.00	44.00	
k1a0.5r0.1	65.00	0.00	-0.02	65.00	65.00	65.00	65.00	65.00	65.00	
k1a0.5r0.3	63.00	0.03	-0.04	63.00	62.00	62.00	62.22	62.00	62.00	
k1a0.5r0.5	67.00	0.37	0.09	67.00	67.00	66.00	66.70	66.40	65.50	
k1a0.5r0.7	66.00	-0.16	-1.11	65.00	64.00	64.00	64.20	64.00	64.00	
k1a0.5r1.0	60.00	-0.04	-0.61	60.00	60.00	59.00	59.54	59.08	58.10	
k1a0.7r0.1	81.00	-0.01	-0.58	81.00	81.00	81.00	80.90	80.80	80.50	
k1a0.7r0.3	81.00	0.03	0.01	81.00	81.00	80.00	80.48	79.96	79.50	
k1a0.7r0.5	80.00	0.00	0.00	80.00	80.00	80.00	80.00	80.00	80.00	
k1a0.7r0.7	79.00	0.02	-0.08	79.00	79.00	79.00	78.90	78.80	78.50	
k1a0.7r1.0	79.00	-0.06	-0.29	78.00	78.00	78.00	78.00	78.00	78.00	
k1a1.0r0.1	99.00	0.11	0.06	99.00	99.00	99.00	99.00	99.00	99.00	
k1a1.0r0.3	99.00	0.00	-0.01	99.00	99.00	99.00	99.00	99.00	99.00	
k1a1.0r0.5	99.00	0.28	0.05	99.00	99.00	99.00	99.00	99.00	99.00	
k1a1.0r0.7	98.00	-0.02	-0.07	98.00	98.00	97.00	97.70	97.40	97.00	
k1a1.0r1.0	97.00	0.00	-0.06	97.00	97.00	97.00	97.00	97.00	97.00	
k2a0.1r0.1	29.00	-0.04	-2.85	29.00	29.00	29.00	28.78	28.56	27.90	
k2a0.1r0.3	30.00	-0.28	-0.41	29.00	29.00	29.00	28.90	28.80	28.50	
k2a0.1r0.5	28.00	-0.23	-1.07	27.00	27.00	27.00	27.00	27.00	27.00	
k2a0.1r0.7	30.00	-0.25	-1.18	29.00	29.00	29.00	29.00	29.00	29.00	
k2a0.1r1.0	26.00	-0.29	-2.02	25.00	25.00	23.00	24.50	24.00	23.00	
k2a0.3r0.1	72.00	-0.19	-0.97	71.00	71.00	70.00	70.54	70.08	69.50	

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Instance	BR-FF-VND	Sim BR-FF-VND (2.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k2a0.3r0.3	68.00	-0.03	-0.34	68.00	68.00	67.00	67.60	67.20	66.50
k2a0.3r0.5	62.00	0.00	-0.07	62.00	62.00	62.00	62.00	62.00	62.00
k2a0.3r0.7	71.00	0.41	-0.94	70.00	70.00	70.00	69.90	69.80	69.50
k2a0.3r1.0	64.00	0.22	-0.91	63.00	63.00	62.00	62.64	62.28	61.60
k2a0.5r0.1	100.00	0.00	-0.03	100.00	100.00	100.00	100.00	100.00	100.00
k2a0.5r0.3	98.00	0.00	-0.03	98.00	98.00	98.00	98.00	98.00	98.00
k2a0.5r0.5	99.00	-0.31	-1.19	97.00	97.00	96.00	96.70	96.40	95.50
k2a0.5r0.7	94.00	-0.11	-0.72	93.00	93.00	92.00	92.68	92.36	91.80
k2a0.5r1.0	86.00	0.44	-0.02	86.00	85.00	85.00	85.06	84.72	84.30
k2a0.7r0.1	118.00	0.02	-0.02	118.00	118.00	117.00	117.80	117.60	117.00
k2a0.7r0.3	115.00	0.02	-0.03	115.00	115.00	114.00	114.70	114.40	114.00
k2a0.7r0.5	114.00	-0.01	-0.06	114.00	114.00	113.00	113.80	113.60	113.00
k2a0.7r0.7	118.00	-0.02	-0.27	118.00	118.00	117.00	117.64	117.28	116.90
k2a0.7r1.0	111.00	-0.04	-0.23	111.00	111.00	109.00	110.20	109.40	108.50
k2a1.0r0.1	151.00	0.00	-0.02	151.00	151.00	151.00	150.90	150.80	150.50
k2a1.0r0.3	150.00	-0.01	-0.06	150.00	150.00	150.00	149.84	149.68	149.20
k2a1.0r0.5	154.00	-0.01	-0.05	154.00	154.00	153.00	153.80	153.60	153.00
k2a1.0r0.7	151.00	-0.10	-0.22	150.00	150.00	150.00	149.90	149.80	149.50
k2a1.0r1.0	142.00	-0.25	-0.67	141.00	140.00	140.00	140.10	139.80	139.50
k3a0.1r0.1	39.00	0.17	-0.38	39.00	39.00	38.00	38.80	38.60	38.00
k3a0.1r0.3	33.00	-1.01	-4.92	31.00	31.00	31.00	30.70	30.40	29.50
k3a0.1r0.5	38.00	-0.79	-2.84	36.00	35.00	34.00	35.20	34.40	34.00
k3a0.1r0.7	39.00	-0.28	-1.90	38.00	38.00	38.00	37.98	37.96	37.90
k3a0.1r1.0	36.00	-0.43	-3.36	35.00	35.00	34.00	34.42	33.84	33.20
k3a0.3r0.1	91.00	-0.01	-1.28	91.00	90.00	90.00	89.96	89.68	89.20
k3a0.3r0.3	92.00	0.06	-0.57	91.00	90.00	90.00	90.04	89.64	89.10
k3a0.3r0.5	85.00	-0.27	-1.20	84.00	84.00	84.00	84.00	84.00	84.00
k3a0.3r0.7	90.00	0.50	0.33	89.00	89.00	88.00	88.56	88.12	87.70
k3a0.3r1.0	86.00	0.40	-0.55	85.00	85.00	84.00	84.70	84.40	84.00
k3a0.5r0.1	128.00	0.00	-0.12	128.00	127.00	126.00	127.10	126.60	126.00
k3a0.5r0.3	129.00	0.29	-0.06	128.00	128.00	127.00	127.74	127.48	126.70
k3a0.5r0.5	126.00	-0.11	-0.39	125.00	125.00	125.00	124.90	124.80	124.50
k3a0.5r0.7	128.00	-0.03	-0.14	128.00	127.00	127.00	127.26	126.92	126.80
k3a0.5r1.0	120.00	0.17	-0.68	120.00	119.00	118.00	119.00	118.20	118.00
k3a0.7r0.1	168.00	-0.01	-0.02	168.00	167.00	167.00	167.50	167.00	167.00
k3a0.7r0.3	162.00	-0.21	-0.63	160.00	159.00	158.00	159.10	158.56	157.90
k3a0.7r0.5	157.00	-0.05	-0.22	156.00	156.00	155.00	155.72	155.44	155.00
k3a0.7r0.7	160.00	0.27	-0.14	160.00	160.00	159.00	159.72	159.44	159.00
k3a0.7r1.0	157.00	0.75	-0.41	156.00	156.00	156.00	155.84	155.68	155.20
k3a1.0r0.1	194.00	-0.04	-0.08	193.00	193.00	193.00	192.98	192.96	192.90
k3a1.0r0.3	168.00	0.00	-0.02	168.00	168.00	168.00	168.00	168.00	168.00
k3a1.0r0.5	202.00	-0.01	-0.41	202.00	201.00	201.00	201.40	200.88	200.70
k3a1.0r0.7	193.00	-0.07	-0.46	191.00	191.00	191.00	190.98	190.96	190.90

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Instance	BR-FF-VND			Sim BR-FF-VND (2.0)			VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%			
k3a1.0r1.0	183.00	-0.05	-0.11	182.00	182.00	182.00	181.98	181.96	181.90			
k5a0.1r0.1	53.00	-0.28	-1.21	49.00	48.00	47.00	48.20	47.60	47.00			
k5a0.1r0.3	58.00	-0.67	-3.33	56.00	56.00	55.00	55.46	54.92	54.30			
k5a0.1r0.5	69.00	-0.23	-3.14	67.00	66.00	65.00	65.92	65.04	64.30			
k5a0.1r0.7	61.00	-0.68	-3.57	58.00	57.00	53.00	56.10	54.40	51.50			
k5a0.1r1.0	57.00	0.51	-4.94	55.00	54.00	53.00	53.58	52.36	50.70			
k5a0.3r0.1	144.00	-0.03	-0.75	143.00	143.00	143.00	143.00	143.00	143.00			
k5a0.3r0.3	129.00	-0.06	-0.50	129.00	127.00	127.00	127.38	126.76	126.40			
k5a0.3r0.5	126.00	0.12	-0.51	124.00	124.00	123.00	123.80	123.60	123.00			
k5a0.3r0.7	123.00	-0.05	-2.48	121.00	120.00	120.00	120.50	120.00	120.00			
k5a0.3r1.0	131.00	0.17	-0.37	131.00	130.00	130.00	130.00	129.80	129.50			
k5a0.5r0.1	190.00	-0.10	-0.30	188.00	188.00	185.00	187.30	186.60	185.00			
k5a0.5r0.3	186.00	0.01	-0.06	186.00	186.00	185.00	185.46	184.92	184.30			
k5a0.5r0.5	194.00	0.41	-0.15	193.00	192.00	192.00	192.20	191.80	191.50			
k5a0.5r0.7	182.00	-0.01	-0.41	182.00	182.00	181.00	181.58	181.16	180.50			
k5a0.5r1.0	180.00	0.06	-0.20	179.00	179.00	178.00	178.72	178.44	178.00			
k5a0.7r0.1	220.00	-0.04	-0.22	219.00	219.00	219.00	218.94	218.88	218.70			
k5a0.7r0.3	229.00	-0.02	-0.09	228.00	228.00	228.00	227.94	227.88	227.70			
k5a0.7r0.5	222.00	-0.22	-0.65	220.00	219.00	219.00	219.32	218.72	218.30			
k5a0.7r0.7	234.00	-0.14	-0.66	232.00	231.00	230.00	230.92	230.16	229.40			
k5a0.7r1.0	229.00	0.35	-0.18	228.00	226.00	226.00	226.60	226.00	226.00			
k5a1.0r0.1	273.00	0.29	0.13	273.00	272.00	272.00	272.50	272.00	272.00			
k5a1.0r0.3	285.00	-0.12	-0.47	284.00	283.00	283.00	283.10	282.80	282.50			
k5a1.0r0.5	282.00	0.58	0.17	282.00	281.00	281.00	281.46	281.00	281.00			
k5a1.0r0.7	293.00	0.00	-0.11	292.00	292.00	292.00	291.90	291.80	291.50			
k5a1.0r1.0	286.00	-0.23	-0.55	284.00	283.00	282.00	282.90	282.00	280.50			
k7a0.1r0.1	85.00	-0.75	-4.43	83.00	82.00	82.00	82.20	81.80	81.50			
k7a0.1r0.3	91.00	0.09	-2.36	90.00	89.00	88.00	88.80	88.40	87.50			
k7a0.1r0.5	82.00	-0.18	-3.14	81.00	80.00	79.00	79.70	79.00	78.50			
k7a0.1r0.7	76.00	0.97	-2.06	75.00	74.00	74.00	74.20	73.80	73.50			
k7a0.1r1.0	72.00	-0.56	-1.93	68.00	67.00	67.00	67.26	66.88	66.70			
k7a0.3r0.1	169.00	-0.20	-1.02	167.00	167.00	167.00	166.90	166.80	166.50			
k7a0.3r0.3	187.00	0.22	-0.78	186.00	184.00	184.00	184.60	184.00	184.00			
k7a0.3r0.5	165.00	0.50	-0.59	164.00	164.00	162.00	163.30	162.60	161.50			
k7a0.3r0.7	171.00	0.14	-0.71	170.00	169.00	169.00	169.04	168.28	167.20			
k7a0.3r1.0	155.00	-0.14	-1.18	151.00	151.00	149.00	150.30	149.60	148.50			
k7a0.5r0.1	247.00	0.11	-0.01	246.00	246.00	244.00	245.40	244.80	244.00			
k7a0.5r0.3	256.00	0.14	0.03	255.00	254.00	253.00	254.00	253.60	253.00			
k7a0.5r0.5	234.00	-0.19	-0.88	232.00	231.00	230.00	230.72	229.84	229.00			
k7a0.5r0.7	245.00	-0.24	-0.46	242.00	242.00	241.00	241.44	240.88	240.00			
k7a0.5r1.0	257.00	-0.07	-0.46	256.00	255.00	254.00	254.46	253.68	251.80			
k7a0.7r0.1	282.00	-0.07	-0.26	281.00	280.00	277.00	279.30	278.20	277.00			
k7a0.7r0.3	307.00	-0.04	-0.51	305.00	304.00	303.00	303.40	302.20	300.00			

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Instance	BR-FF-VND	Sim BR-FF-VND (2.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k7a0.7r0.5	307.00	0.59	0.43	307.00	306.00	304.00	305.70	304.80	303.00
k7a0.7r0.7	302.00	-0.08	-0.93	300.00	300.00	299.00	299.56	299.12	298.70
k7a0.7r1.0	298.00	0.09	-0.15	297.00	297.00	296.00	296.60	296.20	296.00
k7a1.0r0.1	395.00	-0.04	-0.12	393.00	393.00	392.00	392.60	392.20	392.00
k7a1.0r0.3	351.00	-0.03	-0.06	350.00	349.00	349.00	349.08	348.68	348.20
k7a1.0r0.5	344.00	-0.09	-0.26	342.00	342.00	342.00	341.82	341.64	341.10
k7a1.0r0.7	355.00	-0.13	-0.35	353.00	353.00	352.00	352.62	352.24	351.80
k7a1.0r1.0	331.00	-0.04	-0.07	330.00	330.00	329.00	329.80	329.60	329.00
k10a0.1r0.1	108.00	0.62	-2.15	107.00	107.00	105.00	106.00	105.00	103.50
k10a0.1r0.3	111.00	0.16	-1.94	110.00	109.00	108.00	108.70	108.00	106.50
k10a0.1r0.5	121.00	-0.81	-1.09	117.00	115.00	114.00	115.50	114.20	113.50
k10a0.1r0.7	96.00	-0.09	-1.65	93.00	92.00	90.00	91.60	90.64	89.60
k10a0.1r1.0	97.00	-0.20	-1.03	94.00	93.00	92.00	92.90	92.20	92.00
k10a0.3r0.1	255.00	-0.12	-1.01	253.00	253.00	251.00	252.30	251.60	250.50
k10a0.3r0.3	234.00	0.07	-1.62	233.00	233.00	232.00	232.50	232.00	231.50
k10a0.3r0.5	224.00	0.20	-0.69	223.00	222.00	221.00	221.90	221.20	220.20
k10a0.3r0.7	220.00	0.38	-0.62	217.00	215.00	213.00	215.40	214.20	213.00
k10a0.3r1.0	239.00	-0.26	-2.11	236.00	235.00	233.00	234.24	233.40	232.40
k10a0.5r0.1	366.00	-0.15	-0.40	363.00	361.00	360.00	361.00	359.60	358.00
k10a0.5r0.3	335.00	0.07	-0.41	333.00	333.00	331.00	331.94	330.88	329.30
k10a0.5r0.5	324.00	-0.18	-0.41	321.00	321.00	320.00	320.40	319.80	319.20
k10a0.5r0.7	319.00	0.32	-0.10	317.00	316.00	315.00	315.64	314.84	313.90
k10a0.5r1.0	318.00	0.11	-0.23	315.00	314.00	313.00	313.70	313.04	312.10
k10a0.7r0.1	434.00	0.10	-0.07	433.00	432.00	431.00	432.10	431.60	431.00
k10a0.7r0.3	444.00	-0.09	-0.47	442.00	441.00	440.00	440.72	439.88	438.40
k10a0.7r0.5	426.00	-0.16	-0.69	424.00	422.00	422.00	422.40	421.80	421.50
k10a0.7r0.7	394.00	-0.04	-0.36	392.00	392.00	390.00	391.10	390.20	388.50
k10a0.7r1.0	417.00	-0.21	-0.45	413.00	412.00	411.00	411.90	411.00	409.50
k10a1.0r0.1	572.00	0.03	-0.04	571.00	570.00	569.00	569.92	569.04	567.80
k10a1.0r0.3	517.00	-0.09	-0.25	515.00	515.00	514.00	514.60	514.20	514.00
k10a1.0r0.5	478.00	-0.05	-0.39	475.00	474.00	474.00	474.40	474.00	474.00
k10a1.0r0.7	530.00	0.17	-0.01	529.00	528.00	527.00	527.76	527.08	525.80
k10a1.0r1.0	472.00	-0.04	-0.15	470.00	470.00	470.00	469.90	469.80	469.50
Average	167.19	-0.01	-0.71						

Table 1.9: Relative deviations for the Simheuristic best solutions (DevBest %) and average of best solutions (AvgDev %) with a level of uncertainty equal to 0.1 to the BR-FF-VND with 1 minute stop time criterion and the Value at Risk ($VaR\alpha$) and Conditional-Value-at-Risk ($CVaR\alpha$) with three levels of confidence (95%, 97.5% and 99%) of the Simheuristic best solution

Instance	BR-FF-VND	Sim BR-FF-VND (0.1)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k1a0.1r0.1	21.00	-1.29	-2.12	20.00	19.00	19.00	19.40	19.00	19.00
k1a0.1r0.3	22.00	-1.23	-1.35	21.00	21.00	21.00	21.00	21.00	21.00
k1a0.1r0.5	21.00	-1.71	-3.00	19.00	19.00	19.00	19.00	19.00	19.00
k1a0.1r0.7	17.00	-1.69	-2.79	16.00	16.00	15.00	15.56	15.12	15.00
k1a0.1r1.0	20.00	-1.05	-3.71	19.00	19.00	19.00	19.00	19.00	19.00
k1a0.3r0.1	46.00	-0.97	-1.72	44.00	44.00	44.00	44.00	44.00	44.00
k1a0.3r0.3	45.00	-0.12	-0.36	44.00	44.00	44.00	43.94	43.88	43.70
k1a0.3r0.5	46.00	-0.42	-0.78	44.00	44.00	44.00	44.00	44.00	44.00
k1a0.3r0.7	47.00	-0.66	-0.97	46.00	45.00	45.00	45.20	45.00	45.00
k1a0.3r1.0	44.00	-0.50	-1.42	43.00	42.00	41.00	41.90	41.20	41.00
k1a0.5r0.1	65.00	-0.32	-0.47	64.00	63.00	63.00	63.50	63.00	63.00
k1a0.5r0.3	63.00	-0.39	-0.72	62.00	62.00	61.00	61.60	61.20	61.00
k1a0.5r0.5	67.00	0.00	-0.04	67.00	67.00	66.00	66.70	66.40	65.50
k1a0.5r0.7	66.00	-1.59	-2.10	64.00	63.00	63.00	63.20	63.00	63.00
k1a0.5r1.0	60.00	-1.38	-1.95	58.00	57.00	57.00	57.08	56.92	56.80
k1a0.7r0.1	81.00	-0.41	-1.15	79.00	79.00	78.00	78.56	78.12	78.00
k1a0.7r0.3	81.00	-0.25	-0.41	79.00	79.00	79.00	78.84	78.68	78.20
k1a0.7r0.5	80.00	-0.23	-0.40	78.00	78.00	78.00	77.88	77.76	77.40
k1a0.7r0.7	79.00	-0.35	-0.64	78.00	78.00	77.00	77.70	77.40	77.00
k1a0.7r1.0	79.00	-0.38	-0.91	78.00	77.00	77.00	76.80	76.40	75.50
k1a1.0r0.1	99.00	-0.04	-0.08	98.00	98.00	98.00	98.00	98.00	98.00
k1a1.0r0.3	99.00	-0.21	-0.29	97.00	97.00	97.00	97.00	97.00	97.00
k1a1.0r0.5	99.00	0.15	-0.18	98.00	98.00	98.00	98.00	98.00	98.00
k1a1.0r0.7	98.00	-0.27	-0.38	96.00	96.00	96.00	96.00	96.00	96.00
k1a1.0r1.0	97.00	-0.21	-0.49	96.00	96.00	95.00	95.60	95.20	94.60
k2a0.1r0.1	29.00	-1.14	-4.43	27.00	27.00	26.00	26.80	26.60	26.00
k2a0.1r0.3	30.00	-1.93	-2.39	28.00	28.00	27.00	27.70	27.40	27.00
k2a0.1r0.5	28.00	-1.95	-4.93	25.00	24.00	24.00	24.50	24.00	24.00
k2a0.1r0.7	30.00	-2.15	-4.06	27.00	27.00	26.00	26.80	26.60	26.00
k2a0.1r1.0	26.00	-3.62	-5.53	23.00	23.00	23.00	22.90	22.80	22.50
k2a0.3r0.1	71.00	-0.16	-0.37	69.00	68.00	68.00	68.12	67.76	67.40
k2a0.3r0.3	68.00	-0.99	-1.40	65.00	65.00	65.00	64.90	64.80	64.50
k2a0.3r0.5	62.00	-0.75	-1.01	60.00	59.00	59.00	59.10	59.00	59.00
k2a0.3r0.7	71.00	-0.85	-2.02	68.00	68.00	68.00	67.96	67.92	67.80
k2a0.3r1.0	64.00	-1.36	-2.39	60.00	60.00	60.00	59.90	59.80	59.50
k2a0.5r0.1	100.00	-0.19	-0.49	98.00	98.00	97.00	97.50	97.00	96.50
k2a0.5r0.3	98.00	-0.39	-0.63	96.00	95.00	95.00	95.40	94.80	94.50
k2a0.5r0.5	99.00	-1.40	-1.84	96.00	95.00	95.00	95.04	95.00	95.00
k2a0.5r0.7	94.00	-1.10	-1.67	90.00	90.00	90.00	90.00	90.00	90.00
k2a0.5r1.0	86.00	-0.18	-0.75	85.00	84.00	83.00	84.00	83.24	82.40
k2a0.7r0.1	118.00	-0.70	-0.81	115.00	115.00	114.00	114.70	114.40	114.00
k2a0.7r0.3	115.00	-0.25	-0.46	113.00	113.00	112.00	112.72	112.44	111.90

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Instance	BR-FF-VND		Sim BR-FF-VND (0.1)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%	
k2a0.7r0.5	114.00	-0.49	-0.65	112.00	112.00	111.00	111.70	111.40	111.00	
k2a0.7r0.7	118.00	-0.57	-0.89	115.00	115.00	115.00	114.82	114.64	114.10	
k2a0.7r1.0	111.00	-1.01	-1.39	108.00	107.00	107.00	106.90	106.60	106.00	
k2a1.0r0.1	151.00	-0.16	-0.23	149.00	149.00	149.00	149.00	149.00	149.00	
k2a1.0r0.3	150.00	-0.37	-0.43	148.00	148.00	148.00	148.00	148.00	148.00	
k2a1.0r0.5	154.00	-0.24	-0.32	152.00	152.00	151.00	151.60	151.20	151.00	
k2a1.0r0.7	151.00	-0.65	-0.73	149.00	149.00	148.00	148.70	148.40	148.00	
k2a1.0r1.0	142.00	-0.92	-1.22	139.00	139.00	138.00	138.80	138.60	138.00	
k3a0.1r0.1	39.00	-1.13	-2.13	36.00	36.00	35.00	35.70	35.40	34.50	
k3a0.1r0.3	33.00	-3.37	-7.10	29.00	29.00	27.00	27.82	26.64	23.40	
k3a0.1r0.5	38.00	-4.91	-5.54	33.00	31.00	30.00	31.20	30.20	29.00	
k3a0.1r0.7	39.00	-1.79	-3.87	36.00	36.00	36.00	35.64	35.28	34.20	
k3a0.1r1.0	36.00	-3.03	-5.79	32.00	31.00	29.00	31.10	30.20	29.00	
k3a0.3r0.1	91.00	-0.98	-2.23	88.00	87.00	86.00	86.80	86.20	86.00	
k3a0.3r0.3	92.00	-1.36	-1.73	89.00	88.00	87.00	88.20	87.60	87.00	
k3a0.3r0.5	85.00	-1.25	-2.31	82.00	82.00	81.00	81.80	81.60	81.00	
k3a0.3r0.7	90.00	-1.23	-1.39	86.00	86.00	85.00	85.42	84.84	84.50	
k3a0.3r1.0	86.00	-1.34	-1.79	82.00	82.00	82.00	81.90	81.80	81.50	
k3a0.5r0.1	128.00	-0.59	-0.90	125.00	125.00	124.00	124.60	124.20	123.50	
k3a0.5r0.3	129.00	-0.69	-0.97	126.00	125.00	125.00	125.18	124.56	123.90	
k3a0.5r0.5	126.00	-0.96	-1.25	122.00	122.00	121.00	121.50	121.00	120.50	
k3a0.5r0.7	128.00	-0.62	-0.76	125.00	125.00	124.00	124.70	124.40	124.00	
k3a0.5r1.0	120.00	-0.77	-1.50	116.00	115.00	114.00	114.60	114.00	113.50	
k3a0.7r0.1	168.00	-0.38	-0.52	165.00	165.00	165.00	165.00	165.00	165.00	
k3a0.7r0.3	161.00	-0.40	-0.75	159.00	157.00	156.00	157.50	156.60	156.00	
k3a0.7r0.5	157.00	-0.79	-1.01	153.00	153.00	152.00	152.62	152.24	151.90	
k3a0.7r0.7	160.00	-0.20	-0.65	157.00	157.00	156.00	156.60	156.20	156.00	
k3a0.7r1.0	157.00	0.00	-1.03	154.00	153.00	152.00	152.78	152.00	151.60	
k3a1.0r0.1	194.00	-0.36	-0.46	192.00	192.00	192.00	191.94	191.88	191.70	
k3a1.0r0.3	168.00	-0.14	-0.21	167.00	167.00	167.00	167.00	167.00	167.00	
k3a1.0r0.5	202.00	-0.45	-0.72	199.00	199.00	199.00	198.90	198.80	198.50	
k3a1.0r0.7	193.00	-0.53	-0.92	190.00	189.00	189.00	189.20	188.84	188.60	
k3a1.0r1.0	183.00	-0.44	-0.63	180.00	180.00	178.00	179.32	178.64	177.90	
k5a0.1r0.1	53.00	-2.42	-3.56	46.00	45.00	43.00	44.50	43.40	41.50	
k5a0.1r0.3	58.00	-3.73	-6.30	52.00	51.00	49.00	49.98	48.32	46.20	
k5a0.1r0.5	69.00	-2.71	-5.58	62.00	61.00	61.00	61.00	60.40	59.50	
k5a0.1r0.7	61.00	-4.51	-6.91	53.00	53.00	50.00	52.00	51.00	49.50	
k5a0.1r1.0	57.00	-3.23	-7.23	50.00	50.00	48.00	49.10	48.20	47.00	
k5a0.3r0.1	144.00	-0.85	-1.94	139.00	138.00	137.00	137.10	135.20	132.00	
k5a0.3r0.3	129.00	-1.48	-1.87	123.00	122.00	121.00	121.54	120.08	117.70	
k5a0.3r0.5	126.00	-0.79	-1.60	122.00	121.00	119.00	120.60	119.80	119.00	
k5a0.3r0.7	123.00	-1.48	-3.52	118.00	118.00	117.00	117.44	116.88	116.40	
k5a0.3r1.0	131.00	-0.92	-1.57	125.00	123.00	122.00	123.10	122.00	121.50	

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Instance	BR-FF-VND			VaR α			CVaR α		
	BestSol	Sim BestDev (%)	BR-FF-VND (0.1) AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k5a0.5r0.1	190.00	-0.69	-0.89	186.00	185.00	184.00	184.92	184.04	182.90
k5a0.5r0.3	186.00	-0.42	-0.71	182.00	181.00	179.00	180.30	179.28	177.90
k5a0.5r0.5	194.00	-0.21	-0.79	188.00	187.00	186.00	187.00	186.60	186.00
k5a0.5r0.7	182.00	-0.92	-1.51	176.00	175.00	175.00	175.22	174.72	174.30
k5a0.5r1.0	180.00	-0.73	-1.10	175.00	174.00	174.00	174.30	173.60	173.00
k5a0.7r0.1	220.00	-0.46	-0.69	217.00	216.00	215.00	215.78	215.04	213.90
k5a0.7r0.3	229.00	-0.57	-0.81	224.00	222.00	222.00	222.40	221.80	221.50
k5a0.7r0.5	222.00	-0.84	-1.11	217.00	216.00	215.00	215.96	215.44	214.70
k5a0.7r0.7	234.00	-1.05	-1.46	228.00	227.00	227.00	227.30	227.00	227.00
k5a0.7r1.0	229.00	-0.91	-1.32	222.00	221.00	220.00	220.90	220.00	219.50
k5a1.0r0.1	274.00	-0.23	-0.35	272.00	272.00	270.00	271.60	271.20	270.00
k5a1.0r0.3	285.00	-0.68	-0.92	280.00	280.00	279.00	279.80	279.60	279.00
k5a1.0r0.5	282.00	0.21	0.01	280.00	280.00	280.00	279.90	279.80	279.50
k5a1.0r0.7	293.00	-0.34	-0.61	289.00	289.00	288.00	288.70	288.40	288.00
k5a1.0r1.0	286.00	-0.93	-1.31	280.00	278.00	277.00	277.88	276.96	275.90
k7a0.1r0.1	85.00	-3.63	-6.53	77.00	75.00	75.00	75.80	74.80	74.50
k7a0.1r0.3	91.00	-2.10	-4.68	81.00	80.00	78.00	78.22	76.00	71.70
k7a0.1r0.5	82.00	-2.97	-5.33	74.00	74.00	72.00	73.40	72.80	72.00
k7a0.1r0.7	76.00	-2.88	-5.20	67.00	66.00	65.00	66.00	65.00	64.50
k7a0.1r1.0	72.00	-3.38	-4.61	64.00	61.00	60.00	61.08	59.40	57.90
k7a0.3r0.1	169.00	-1.13	-2.07	163.00	162.00	160.00	161.90	161.00	160.00
k7a0.3r0.3	187.00	-1.55	-2.07	178.00	177.00	175.00	176.90	176.00	175.00
k7a0.3r0.5	165.00	-0.62	-2.06	158.00	156.00	154.00	156.10	154.80	154.00
k7a0.3r0.7	171.00	-1.24	-1.85	164.00	162.00	159.00	160.90	158.84	155.60
k7a0.3r1.0	155.00	-1.89	-2.67	146.00	145.00	143.00	144.60	143.60	142.50
k7a0.5r0.1	247.00	-0.71	-0.80	240.00	239.00	237.00	238.18	236.64	233.60
k7a0.5r0.3	256.00	-0.75	-0.85	250.00	248.00	247.00	248.50	247.40	246.50
k7a0.5r0.5	234.00	-1.16	-1.77	225.00	223.00	223.00	223.50	223.00	223.00
k7a0.5r0.7	245.00	-1.20	-1.38	238.00	237.00	235.00	236.06	234.68	232.50
k7a0.5r1.0	257.00	-1.19	-1.47	250.00	247.00	245.00	247.10	245.40	244.00
k7a0.7r0.1	282.00	-0.70	-0.88	274.00	273.00	272.00	273.22	272.48	271.70
k7a0.7r0.3	307.00	-0.86	-1.23	300.00	299.00	298.00	298.60	297.80	296.80
k7a0.7r0.5	307.00	0.16	-0.17	303.00	302.00	301.00	301.90	301.20	300.50
k7a0.7r0.7	302.00	-0.72	-1.49	295.00	294.00	293.00	294.18	293.48	292.70
k7a0.7r1.0	298.00	-0.58	-1.04	292.00	291.00	288.00	290.20	289.00	287.00
k7a1.0r0.1	395.00	-0.28	-0.49	391.00	390.00	385.00	388.80	387.40	385.00
k7a1.0r0.3	351.00	-0.26	-0.33	347.00	346.00	346.00	346.02	345.76	345.40
k7a1.0r0.5	344.00	-0.49	-0.66	339.00	339.00	338.00	338.58	338.16	337.60
k7a1.0r0.7	355.00	-0.60	-0.89	350.00	349.00	348.00	349.00	348.40	348.00
k7a1.0r1.0	331.00	-0.29	-0.42	328.00	327.00	327.00	327.08	326.72	326.30
k10a0.1r0.1	108.00	-1.58	-5.09	102.00	101.00	98.00	100.20	98.60	95.50
k10a0.1r0.3	111.00	-1.81	-4.60	101.00	99.00	96.00	98.10	96.40	93.00
k10a0.1r0.5	121.00	-2.46	-3.98	112.00	110.00	109.00	109.72	108.56	107.40

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Instance	BR-FF-VND	Sim BR-FF-VND (0.1)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k10a0.1r0.7	96.00	-2.88	-3.55	85.00	84.00	81.00	82.64	81.08	79.00
k10a0.1r1.0	97.00	-2.24	-3.63	90.00	88.00	85.00	88.10	86.40	84.50
k10a0.3r0.1	255.00	-1.45	-2.15	242.00	239.00	237.00	238.90	237.00	234.00
k10a0.3r0.3	234.00	-0.87	-2.94	226.00	224.00	222.00	223.78	222.36	220.80
k10a0.3r0.5	224.00	-1.39	-2.08	210.00	207.00	205.00	207.02	205.24	203.50
k10a0.3r0.7	220.00	-1.25	-2.30	208.00	206.00	204.00	205.50	204.20	202.50
k10a0.3r1.0	239.00	-2.12	-3.59	226.00	224.00	223.00	224.12	222.92	221.70
k10a0.5r0.1	366.00	-0.83	-1.10	358.00	355.00	354.00	355.10	354.00	353.50
k10a0.5r0.3	335.00	-0.79	-1.24	325.00	323.00	321.00	322.18	320.60	318.40
k10a0.5r0.5	324.00	-1.07	-1.35	313.00	312.00	311.00	311.52	310.48	309.30
k10a0.5r0.7	319.00	-0.93	-1.23	309.00	307.00	305.00	306.62	305.20	303.70
k10a0.5r1.0	318.00	-1.13	-1.44	308.00	307.00	303.00	306.30	304.60	302.50
k10a0.7r0.1	434.00	-0.62	-0.66	426.00	424.00	421.00	422.80	420.80	417.50
k10a0.7r0.3	444.00	-0.75	-1.08	433.00	432.00	428.00	431.04	429.36	427.40
k10a0.7r0.5	426.00	-0.93	-1.39	417.00	414.00	413.00	414.50	413.00	412.00
k10a0.7r0.7	394.00	-0.91	-1.24	385.00	383.00	382.00	382.80	381.60	380.00
k10a0.7r1.0	417.00	-1.03	-1.29	405.00	404.00	402.00	403.06	401.52	399.60
k10a1.0r0.1	572.00	-0.27	-0.44	563.00	562.00	559.00	560.96	559.20	556.60
k10a1.0r0.3	517.00	-0.44	-0.54	510.00	509.00	507.00	508.40	507.20	505.50
k10a1.0r0.5	478.00	-0.56	-0.86	470.00	470.00	469.00	469.60	469.20	469.00
k10a1.0r0.7	530.00	-0.29	-0.52	522.00	521.00	519.00	520.50	519.60	518.00
k10a1.0r1.0	472.00	-0.52	-0.63	466.00	465.00	462.00	464.10	463.00	462.00
Average	167.18	-1.05	-1.79						

Table 1.10: Relative deviations for the Simheuristic best solutions (DevBest %) and average of best solutions (AvgDev %) with a level of uncertainty equal to 0.5 to the BR-FF-VND with 1 minute stop time criterion and the Value at Risk ($VaR\alpha$) and Conditional-Value-at-Risk ($CVaR\alpha$) with three levels of confidence (95%, 97.5% and 99%) of the Simheuristic best solution

Instance	BR-FF-VND	Sim BR-FF-VND (0.5)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k1a0.1r0.1	21.00	-2.29	-3.15	19.00	19.00	19.00	19.00	19.00	19.00
k1a0.1r0.3	22.00	-2.02	-2.43	21.00	20.00	20.00	20.30	19.80	19.50
k1a0.1r0.5	21.00	-3.36	-4.70	19.00	19.00	18.00	18.80	18.60	18.00
k1a0.1r0.7	17.00	-3.51	-4.15	15.00	15.00	15.00	14.84	14.68	14.20
k1a0.1r1.0	20.00	-2.40	-5.49	18.00	18.00	18.00	17.90	17.80	17.50
k1a0.3r0.1	46.00	-1.75	-2.58	44.00	44.00	44.00	43.96	43.92	43.80
k1a0.3r0.3	45.00	-0.79	-1.07	44.00	43.00	43.00	43.36	42.80	42.50

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Instance	BR-FF-VND		Sim BR-FF-VND (0.5)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%	
k1a0.3r0.5	46.00	-1.23	-1.74	44.00	44.00	44.00	43.80	43.60	43.00	
k1a0.3r0.7	47.00	-1.27	-1.68	45.00	45.00	45.00	44.90	44.80	44.50	
k1a0.3r1.0	44.00	-1.67	-2.78	41.00	41.00	41.00	40.50	40.00	38.50	
k1a0.5r0.1	65.00	-0.76	-0.90	63.00	63.00	63.00	62.88	62.76	62.40	
k1a0.5r0.3	63.00	-0.75	-1.24	61.00	61.00	60.00	60.70	60.40	60.00	
k1a0.5r0.5	67.00	-0.18	-0.25	66.00	66.00	65.00	65.60	65.20	65.00	
k1a0.5r0.7	66.00	-2.04	-2.68	63.00	63.00	63.00	62.90	62.80	62.50	
k1a0.5r1.0	60.00	-2.34	-2.98	57.00	57.00	56.00	56.54	56.08	55.60	
k1a0.7r0.1	81.00	-0.96	-1.58	78.00	78.00	78.00	77.96	77.92	77.80	
k1a0.7r0.3	81.00	-0.70	-0.86	78.00	78.00	78.00	77.98	77.96	77.90	
k1a0.7r0.5	80.00	-0.75	-0.93	77.00	77.00	77.00	76.92	76.84	76.60	
k1a0.7r0.7	79.00	-0.73	-1.11	77.00	77.00	76.00	76.60	76.20	76.00	
k1a0.7r1.0	79.00	-0.75	-1.36	77.00	77.00	75.00	76.20	75.40	74.50	
k1a1.0r0.1	99.00	-0.23	-0.31	98.00	98.00	97.00	97.60	97.20	97.00	
k1a1.0r0.3	99.00	-0.49	-0.65	97.00	97.00	96.00	96.80	96.60	96.00	
k1a1.0r0.5	99.00	-0.11	-0.40	98.00	98.00	97.00	97.80	97.60	97.00	
k1a1.0r0.7	98.00	-0.43	-0.63	96.00	96.00	96.00	95.94	95.88	95.70	
k1a1.0r1.0	97.00	-0.55	-0.97	94.00	94.00	93.00	93.76	93.52	93.00	
k2a0.1r0.1	29.00	-2.14	-5.64	27.00	26.00	25.00	25.90	25.00	24.00	
k2a0.1r0.3	30.00	-3.48	-3.98	26.00	26.00	26.00	26.00	26.00	26.00	
k2a0.1r0.5	28.00	-4.27	-7.16	24.00	23.00	23.00	23.30	22.60	22.00	
k2a0.1r0.7	30.00	-4.18	-6.11	26.00	25.00	22.00	24.70	23.40	21.50	
k2a0.1r1.0	26.00	-5.75	-8.14	22.00	21.00	21.00	21.30	20.80	20.50	
k2a0.3r0.1	71.00	-0.74	-0.96	68.00	68.00	67.00	67.80	67.60	67.00	
k2a0.3r0.3	68.00	-1.90	-2.25	64.00	64.00	64.00	64.00	64.00	64.00	
k2a0.3r0.5	62.00	-1.59	-1.90	59.00	59.00	58.00	58.70	58.40	58.00	
k2a0.3r0.7	71.00	-1.72	-2.95	68.00	67.00	66.00	66.86	66.24	65.70	
k2a0.3r1.0	64.00	-2.41	-3.60	61.00	60.00	59.00	60.20	59.60	59.00	
k2a0.5r0.1	100.00	-0.63	-0.93	97.00	96.00	96.00	96.06	95.56	94.90	
k2a0.5r0.3	98.00	-0.94	-1.26	95.00	94.00	93.00	94.10	93.40	92.50	
k2a0.5r0.5	99.00	-1.76	-2.32	95.00	95.00	94.00	94.74	94.48	93.90	
k2a0.5r0.7	94.00	-2.06	-2.45	90.00	89.00	88.00	89.00	88.20	87.50	
k2a0.5r1.0	86.00	-0.65	-1.38	83.00	82.00	81.00	81.70	80.80	80.00	
k2a0.7r0.1	118.00	-1.26	-1.39	114.00	114.00	114.00	113.90	113.80	113.50	
k2a0.7r0.3	115.00	-0.62	-0.92	112.00	110.00	110.00	110.80	110.00	110.00	
k2a0.7r0.5	114.00	-0.97	-1.17	111.00	110.00	110.00	110.46	109.92	109.80	
k2a0.7r0.7	118.00	-1.03	-1.36	114.00	114.00	114.00	113.88	113.76	113.40	
k2a0.7r1.0	111.00	-1.77	-2.04	106.00	104.00	104.00	104.46	103.88	103.70	
k2a1.0r0.1	151.00	-0.23	-0.35	149.00	149.00	148.00	148.80	148.60	148.00	
k2a1.0r0.3	150.00	-0.37	-0.53	148.00	148.00	148.00	147.90	147.80	147.50	
k2a1.0r0.5	154.00	-0.55	-0.65	151.00	150.00	150.00	150.20	149.80	149.50	
k2a1.0r0.7	151.00	-0.96	-1.03	148.00	147.00	147.00	147.30	146.84	146.60	
k2a1.0r1.0	142.00	-1.39	-1.64	138.00	137.00	136.00	136.70	136.32	136.00	

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Instance	BR-FF-VND			VaR α			CVaR α		
	BestSol	Sim BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k3a0.1r0.1	39.00	-2.74	-3.51	35.00	34.00	33.00	34.30	33.60	33.00
k3a0.1r0.3	33.00	-5.23	-8.79	29.00	28.00	26.00	26.60	24.80	20.00
k3a0.1r0.5	38.00	-6.76	-7.54	31.00	30.00	28.00	29.60	28.20	27.00
k3a0.1r0.7	39.00	-3.37	-5.47	35.00	33.00	33.00	33.40	32.20	31.00
k3a0.1r1.0	36.00	-5.17	-7.81	30.00	30.00	29.00	29.40	28.80	27.50
k3a0.3r0.1	91.00	-1.74	-3.05	86.00	85.00	85.00	85.30	85.00	85.00
k3a0.3r0.3	92.00	-2.29	-2.51	87.00	86.00	86.00	86.40	85.80	85.50
k3a0.3r0.5	85.00	-1.99	-3.23	81.00	80.00	79.00	80.30	79.60	79.00
k3a0.3r0.7	90.00	-2.32	-2.48	84.00	84.00	82.00	83.40	82.80	82.00
k3a0.3r1.0	86.00	-2.33	-2.90	82.00	80.00	78.00	79.90	78.80	77.00
k3a0.5r0.1	128.00	-1.09	-1.48	124.00	123.00	122.00	122.60	122.00	121.00
k3a0.5r0.3	129.00	-1.28	-1.63	125.00	124.00	124.00	124.50	124.00	124.00
k3a0.5r0.5	126.00	-1.62	-2.00	121.00	120.00	119.00	120.00	119.08	118.10
k3a0.5r0.7	128.00	-1.15	-1.37	123.00	123.00	122.00	122.60	122.20	122.00
k3a0.5r1.0	120.00	-1.83	-2.45	113.00	112.00	111.00	111.70	111.00	110.50
k3a0.7r0.1	168.00	-0.75	-0.95	164.00	164.00	162.00	163.22	162.44	161.60
k3a0.7r0.3	161.00	-0.91	-1.30	157.00	156.00	155.00	155.70	155.00	154.50
k3a0.7r0.5	157.00	-1.40	-1.59	152.00	151.00	151.00	151.30	150.80	150.50
k3a0.7r0.7	160.00	-0.72	-1.18	156.00	155.00	154.00	154.34	153.60	152.80
k3a0.7r1.0	157.00	-0.57	-1.46	152.00	151.00	151.00	150.96	150.60	150.00
k3a1.0r0.1	194.00	-0.60	-0.74	191.00	191.00	190.00	190.58	190.16	189.50
k3a1.0r0.3	168.00	-0.30	-0.36	167.00	167.00	166.00	166.80	166.60	166.00
k3a1.0r0.5	202.00	-0.81	-1.01	198.00	198.00	197.00	197.50	197.00	196.50
k3a1.0r0.7	193.00	-0.99	-1.28	188.00	188.00	187.00	187.72	187.44	186.70
k3a1.0r1.0	183.00	-0.89	-1.09	178.00	177.00	176.00	176.88	175.88	174.90
k5a0.1r0.1	53.00	-3.59	-5.23	44.00	42.00	40.00	41.80	40.40	38.50
k5a0.1r0.3	58.00	-6.44	-8.54	49.00	47.00	44.00	45.84	43.96	41.60
k5a0.1r0.5	69.00	-5.04	-7.91	59.00	57.00	55.00	56.70	55.40	53.00
k5a0.1r0.7	61.00	-7.72	-9.46	50.00	49.00	47.00	48.20	46.80	45.00
k5a0.1r1.0	57.00	-5.95	-9.44	48.00	47.00	46.00	46.80	46.20	45.50
k5a0.3r0.1	144.00	-1.73	-2.84	136.00	135.00	131.00	132.58	129.40	123.50
k5a0.3r0.3	129.00	-2.64	-3.06	120.00	119.00	118.00	119.10	118.20	117.00
k5a0.3r0.5	126.00	-1.62	-2.55	119.00	118.00	116.00	117.48	116.20	114.30
k5a0.3r0.7	123.00	-2.22	-4.60	117.00	116.00	114.00	115.40	114.20	112.50
k5a0.3r1.0	131.00	-2.27	-2.74	122.00	121.00	121.00	121.10	120.60	120.00
k5a0.5r0.1	189.00	-0.70	-1.00	183.00	182.00	181.00	181.30	179.96	178.10
k5a0.5r0.3	186.00	-1.05	-1.33	179.00	178.00	177.00	177.62	176.44	174.70
k5a0.5r0.5	194.00	-0.84	-1.38	186.00	185.00	183.00	184.28	182.88	180.90
k5a0.5r0.7	182.00	-1.87	-2.33	174.00	173.00	172.00	173.00	172.08	170.80
k5a0.5r1.0	180.00	-1.56	-1.94	173.00	171.00	169.00	171.00	169.60	168.00
k5a0.7r0.1	220.00	-0.91	-1.12	214.00	213.00	212.00	212.92	212.04	211.10
k5a0.7r0.3	229.00	-1.16	-1.39	222.00	221.00	220.00	221.00	220.00	219.50
k5a0.7r0.5	222.00	-1.41	-1.65	215.00	213.00	211.00	212.54	211.16	209.90

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Instance	BR-FF-VND			VaR α			CVaR α		
	BestSol	Sim BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k5a0.7r0.7	234.00	-1.55	-1.97	226.00	225.00	224.00	225.00	224.40	224.00
k5a0.7r1.0	229.00	-1.78	-2.24	220.00	218.00	213.00	217.50	216.00	213.00
k5a1.0r0.1	273.00	-0.01	-0.17	271.00	270.00	268.00	269.80	269.00	267.50
k5a1.0r0.3	285.00	-1.02	-1.21	279.00	278.00	278.00	278.20	277.80	277.50
k5a1.0r0.5	282.00	-0.03	-0.20	279.00	278.00	277.00	277.94	277.20	276.30
k5a1.0r0.7	293.00	-0.74	-1.08	287.00	286.00	284.00	285.60	284.60	283.50
k5a1.0r1.0	286.00	-1.48	-1.83	276.00	275.00	273.00	274.26	272.88	271.20
k7a0.1r0.1	85.00	-5.46	-8.43	74.00	72.00	70.00	71.70	70.20	68.50
k7a0.1r0.3	91.00	-4.23	-6.75	78.00	75.00	71.00	72.74	68.72	61.70
k7a0.1r0.5	82.00	-5.50	-7.20	70.00	69.00	67.00	68.18	66.52	63.50
k7a0.1r0.7	76.00	-5.71	-7.62	64.00	63.00	60.00	60.82	58.12	53.20
k7a0.1r1.0	72.00	-5.85	-6.61	60.00	59.00	56.00	57.82	56.16	54.10
k7a0.3r0.1	169.00	-2.04	-3.01	159.00	157.00	155.00	156.40	155.00	153.50
k7a0.3r0.3	187.00	-2.66	-3.13	176.00	175.00	174.00	174.40	173.60	172.50
k7a0.3r0.5	165.00	-1.72	-3.19	154.00	151.00	150.00	150.90	149.80	149.00
k7a0.3r0.7	171.00	-2.52	-3.14	159.00	155.00	153.00	155.40	153.80	153.00
k7a0.3r1.0	155.00	-2.99	-3.80	143.00	142.00	140.00	141.80	140.60	139.00
k7a0.5r0.1	247.00	-1.49	-1.62	237.00	235.00	233.00	235.10	234.00	233.00
k7a0.5r0.3	256.00	-1.41	-1.61	246.00	244.00	241.00	244.00	242.40	241.00
k7a0.5r0.5	234.00	-2.07	-2.50	223.00	222.00	220.00	221.06	219.52	217.70
k7a0.5r0.7	244.00	-1.44	-1.73	233.00	231.00	229.00	230.90	229.20	227.00
k7a0.5r1.0	257.00	-2.13	-2.42	243.00	243.00	240.00	242.00	241.00	239.00
k7a0.7r0.1	282.00	-1.21	-1.39	273.00	271.00	269.00	270.80	269.00	267.00
k7a0.7r0.3	307.00	-1.52	-1.85	295.00	293.00	291.00	292.60	290.60	287.50
k7a0.7r0.5	307.00	-0.33	-0.83	300.00	299.00	297.00	297.94	296.52	294.20
k7a0.7r0.7	302.00	-1.28	-2.06	292.00	290.00	287.00	289.22	287.72	286.20
k7a0.7r1.0	298.00	-1.32	-1.67	289.00	287.00	285.00	286.60	285.20	283.00
k7a1.0r0.1	395.00	-0.66	-0.83	386.00	385.00	381.00	384.60	383.20	381.00
k7a1.0r0.3	351.00	-0.47	-0.56	346.00	345.00	345.00	345.10	345.00	345.00
k7a1.0r0.5	344.00	-0.83	-1.02	337.00	336.00	336.00	336.40	335.84	335.60
k7a1.0r0.7	355.00	-0.91	-1.24	348.00	346.00	344.00	345.70	344.80	344.00
k7a1.0r1.0	331.00	-0.62	-0.75	326.00	325.00	324.00	325.04	324.20	323.30
k10a0.1r0.1	108.00	-3.19	-6.14	98.00	97.00	95.00	96.10	94.40	92.50
k10a0.1r0.3	111.00	-4.23	-6.76	96.00	93.00	89.00	91.70	88.60	82.50
k10a0.1r0.5	121.00	-4.08	-6.01	108.00	106.00	103.00	104.90	103.24	100.80
k10a0.1r0.7	96.00	-4.96	-5.39	82.00	80.00	78.00	78.18	75.64	70.70
k10a0.1r1.0	97.00	-4.00	-5.49	86.00	84.00	81.00	83.70	82.20	81.00
k10a0.3r0.1	255.00	-2.69	-3.26	237.00	235.00	232.00	232.72	229.16	221.60
k10a0.3r0.3	234.00	-1.99	-4.02	221.00	218.00	216.00	218.10	216.40	214.50
k10a0.3r0.5	224.00	-2.89	-3.35	207.00	204.00	202.00	203.50	201.60	198.50
k10a0.3r0.7	220.00	-2.48	-3.55	203.00	199.00	195.00	198.90	196.20	194.50
k10a0.3r1.0	239.00	-3.57	-4.89	220.00	218.00	216.00	217.24	216.00	214.70
k10a0.5r0.1	366.00	-1.48	-1.75	352.00	350.00	348.00	348.62	346.04	341.20

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Instance	BR-FF-VND	Sim BR-FF-VND (0.5)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k10a0.5r0.3	335.00	-1.48	-1.94	321.00	318.00	315.00	318.20	315.80	314.00
k10a0.5r0.5	324.00	-1.95	-2.23	307.00	306.00	304.00	304.88	303.24	301.20
k10a0.5r0.7	319.00	-1.87	-2.12	304.00	303.00	299.00	301.74	299.92	297.80
k10a0.5r1.0	318.00	-2.09	-2.42	303.00	301.00	297.00	300.40	298.60	296.50
k10a0.7r0.1	434.00	-1.13	-1.21	420.00	420.00	411.00	417.00	414.00	406.50
k10a0.7r0.3	444.00	-1.41	-1.68	428.00	425.00	423.00	425.40	423.60	422.50
k10a0.7r0.5	426.00	-1.64	-2.06	410.00	405.00	404.00	406.20	403.80	402.50
k10a0.7r0.7	394.00	-1.50	-1.88	380.00	375.00	372.00	375.70	373.20	371.50
k10a0.7r1.0	417.00	-1.79	-2.05	401.00	399.00	394.00	397.90	396.00	394.00
k10a1.0r0.1	572.00	-0.63	-0.79	559.00	556.00	551.00	554.96	552.48	548.80
k10a1.0r0.3	517.00	-0.68	-0.76	509.00	507.00	504.00	506.80	505.20	504.00
k10a1.0r0.5	478.00	-0.96	-1.24	467.00	466.00	465.00	466.00	465.60	465.00
k10a1.0r0.7	530.00	-0.79	-0.99	518.00	516.00	515.00	515.90	515.00	514.00
k10a1.0r1.0	472.00	-0.90	-0.99	463.00	462.00	459.00	460.84	459.60	457.90
Average	167.16	-1.94	-2.67						

Table 1.11: Relative deviations for the Simheuristic best solutions (DevBest %) and average of best solutions (AvgDev %) with a level of uncertainty equal to 1.0 to the BR-FF-VND with 1 minute stop time criterion and the Value at Risk ($VaR\alpha$) and Conditional-Value-at-Risk ($CVaR\alpha$) with three levels of confidence (95%, 97.5% and 99%) of the Simheuristic best solution

Instance	BR-FF-VND	Sim BR-FF-VND (1.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k1a0.1r0.1	21.00	-3.55	-4.51	18.00	18.00	16.00	17.60	17.20	16.00
k1a0.1r0.3	22.00	-3.64	-4.11	20.00	19.00	19.00	19.00	18.80	18.50
k1a0.1r0.5	21.00	-5.43	-6.42	18.00	18.00	17.00	17.80	17.60	17.00
k1a0.1r0.7	17.00	-5.79	-6.32	14.00	14.00	13.00	13.70	13.40	13.00
k1a0.1r1.0	20.00	-4.57	-7.95	17.00	16.00	16.00	16.30	16.00	16.00
k1a0.3r0.1	46.00	-2.54	-3.40	42.00	42.00	41.00	41.60	41.20	41.00
k1a0.3r0.3	45.00	-1.82	-2.12	42.00	42.00	42.00	41.88	41.76	41.40
k1a0.3r0.5	46.00	-2.42	-2.80	43.00	42.00	42.00	42.30	42.00	42.00
k1a0.3r0.7	47.00	-2.21	-2.56	44.00	44.00	44.00	43.90	43.80	43.50
k1a0.3r1.0	44.00	-3.50	-4.64	41.00	39.00	36.00	39.20	37.60	36.00
k1a0.5r0.1	65.00	-1.34	-1.49	62.00	61.00	61.00	61.50	61.00	61.00
k1a0.5r0.3	63.00	-1.33	-1.93	60.00	60.00	59.00	59.70	59.40	58.90
k1a0.5r0.5	67.00	-0.74	-0.80	65.00	65.00	64.00	64.50	64.00	63.50
k1a0.5r0.7	66.00	-2.86	-3.48	63.00	63.00	62.00	62.70	62.40	62.00
k1a0.5r1.0	60.00	-3.60	-4.38	56.00	55.00	54.00	54.80	54.16	53.20

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Instance	BR-FF-VND			Sim BR-FF-VND (1.0)			VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%	95%	97.5%	99%
k1a0.7r0.1	81.00	-1.75	-2.17	77.00	77.00	76.00	76.72	76.44	75.80			
k1a0.7r0.3	81.00	-1.22	-1.42	78.00	78.00	77.00	77.70	77.40	76.50			
k1a0.7r0.5	80.00	-1.44	-1.65	78.00	78.00	76.00	77.50	77.00	76.00			
k1a0.7r0.7	79.00	-1.37	-1.72	76.00	76.00	75.00	75.70	75.40	75.00			
k1a0.7r1.0	79.00	-1.48	-2.03	74.00	74.00	73.00	73.70	73.40	72.90			
k1a1.0r0.1	99.00	-0.61	-0.70	97.00	97.00	96.00	96.70	96.40	96.00			
k1a1.0r0.3	99.00	-0.95	-1.12	96.00	96.00	96.00	96.00	96.00	96.00			
k1a1.0r0.5	99.00	-0.45	-0.73	97.00	97.00	97.00	96.82	96.64	96.10			
k1a1.0r0.7	98.00	-0.77	-0.95	96.00	95.00	95.00	95.14	95.00	95.00			
k1a1.0r1.0	97.00	-1.23	-1.62	93.00	93.00	92.00	92.48	91.96	91.10			
k2a0.1r0.1	29.00	-3.53	-6.92	25.00	25.00	24.00	24.60	24.20	23.00			
k2a0.1r0.3	30.00	-5.54	-6.10	26.00	25.00	25.00	25.08	24.48	23.70			
k2a0.1r0.5	28.00	-8.12	-9.48	21.00	20.00	20.00	20.04	19.16	17.90			
k2a0.1r0.7	30.00	-8.35	-9.44	24.00	23.00	22.00	22.90	22.20	21.50			
k2a0.1r1.0	26.00	-9.96	-11.40	20.00	19.00	18.00	19.00	18.20	18.00			
k2a0.3r0.1	71.00	-1.52	-1.75	67.00	66.00	66.00	66.10	65.80	65.50			
k2a0.3r0.3	68.00	-2.99	-3.36	63.00	63.00	62.00	62.54	62.08	61.30			
k2a0.3r0.5	62.00	-2.61	-3.15	58.00	58.00	57.00	57.40	56.80	56.30			
k2a0.3r0.7	71.00	-2.92	-4.19	66.00	65.00	64.00	65.02	64.12	62.80			
k2a0.3r1.0	64.00	-3.50	-5.27	58.00	57.00	56.00	57.20	56.60	56.00			
k2a0.5r0.1	100.00	-1.24	-1.51	95.00	95.00	94.00	94.50	94.00	93.50			
k2a0.5r0.3	98.00	-1.81	-2.11	94.00	92.00	92.00	92.50	91.60	91.00			
k2a0.5r0.5	99.00	-2.33	-2.99	94.00	93.00	92.00	92.80	92.00	91.50			
k2a0.5r0.7	94.00	-3.18	-3.47	87.00	87.00	85.00	86.40	85.80	85.00			
k2a0.5r1.0	86.00	-1.84	-2.65	80.00	79.00	78.00	78.90	78.44	77.70			
k2a0.7r0.1	118.00	-1.86	-2.01	113.00	113.00	112.00	112.50	112.00	111.50			
k2a0.7r0.3	115.00	-1.28	-1.61	110.00	109.00	108.00	109.20	108.40	108.00			
k2a0.7r0.5	114.00	-1.72	-1.92	109.00	109.00	107.00	108.32	107.64	106.50			
k2a0.7r0.7	118.00	-1.65	-1.96	113.00	113.00	112.00	112.52	112.04	111.20			
k2a0.7r1.0	111.00	-2.96	-3.15	103.00	103.00	101.00	102.40	101.80	101.00			
k2a1.0r0.1	151.00	-0.38	-0.52	149.00	148.00	148.00	147.90	147.60	147.00			
k2a1.0r0.3	150.00	-0.62	-0.70	148.00	147.00	147.00	146.82	146.56	145.90			
k2a1.0r0.5	154.00	-1.01	-1.14	150.00	149.00	149.00	148.90	148.40	147.50			
k2a1.0r0.7	151.00	-1.41	-1.48	147.00	146.00	145.00	145.78	145.20	144.50			
k2a1.0r1.0	142.00	-2.06	-2.27	136.00	135.00	135.00	135.40	134.84	134.60			
k3a0.1r0.1	39.00	-4.53	-5.34	34.00	33.00	30.00	32.10	30.80	29.50			
k3a0.1r0.3	33.00	-7.59	-10.71	27.00	27.00	22.00	24.60	22.20	15.00			
k3a0.1r0.5	38.00	-9.37	-9.96	33.00	31.00	25.00	29.60	27.60	24.50			
k3a0.1r0.7	39.00	-6.05	-8.06	32.00	31.00	30.00	30.50	29.20	27.00			
k3a0.1r1.0	36.00	-8.68	-10.62	29.00	28.00	25.00	27.30	26.00	24.50			
k3a0.3r0.1	91.00	-2.81	-4.12	84.00	83.00	82.00	83.20	82.40	82.00			
k3a0.3r0.3	92.00	-3.33	-3.57	86.00	85.00	84.00	84.90	84.20	83.50			
k3a0.3r0.5	85.00	-3.25	-4.45	79.00	78.00	77.00	77.80	77.20	77.00			

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Instance	BR-FF-VND		Sim BR-FF-VND (1.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%	
k3a0.3r0.7	90.00	-3.67	-3.90	82.00	81.00	80.00	80.70	80.00	79.00	
k3a0.3r1.0	86.00	-3.69	-4.44	79.00	78.00	77.00	77.34	76.28	74.80	
k3a0.5r0.1	128.00	-1.86	-2.30	121.00	121.00	119.00	120.30	119.60	119.00	
k3a0.5r0.3	129.00	-2.13	-2.52	123.00	122.00	121.00	121.90	121.00	120.50	
k3a0.5r0.5	126.00	-2.53	-3.01	119.00	118.00	116.00	117.28	116.24	114.90	
k3a0.5r0.7	128.00	-2.12	-2.36	120.00	120.00	119.00	119.80	119.60	119.00	
k3a0.5r1.0	120.00	-3.51	-3.82	109.00	108.00	106.00	107.90	106.80	106.00	
k3a0.7r0.1	168.00	-1.30	-1.54	162.00	161.00	160.00	160.64	159.88	159.10	
k3a0.7r0.3	161.00	-1.84	-2.06	155.00	154.00	154.00	154.00	153.80	153.50	
k3a0.7r0.5	157.00	-2.06	-2.32	150.00	149.00	148.00	148.84	147.80	147.00	
k3a0.7r0.7	160.00	-1.37	-2.01	153.00	152.00	150.00	151.60	150.60	149.00	
k3a0.7r1.0	157.00	-1.34	-2.12	150.00	149.00	148.00	148.52	147.76	146.80	
k3a1.0r0.1	194.00	-1.06	-1.15	189.00	188.00	188.00	188.10	187.32	186.30	
k3a1.0r0.3	168.00	-0.46	-0.53	166.00	166.00	165.00	165.80	165.60	165.00	
k3a1.0r0.5	202.00	-1.23	-1.43	197.00	196.00	192.00	195.20	193.80	192.00	
k3a1.0r0.7	193.00	-1.55	-1.74	187.00	186.00	186.00	186.40	185.80	185.50	
k3a1.0r1.0	183.00	-1.63	-1.86	175.00	174.00	173.00	173.38	172.40	171.30	
k5a0.1r0.1	53.00	-5.73	-7.56	42.00	40.00	36.00	39.20	37.20	33.00	
k5a0.1r0.3	58.00	-9.83	-11.60	44.00	43.00	40.00	41.64	39.52	35.70	
k5a0.1r0.5	69.00	-8.57	-11.41	52.00	49.00	48.00	49.60	48.00	46.50	
k5a0.1r0.7	61.00	-10.95	-13.00	47.00	44.00	42.00	44.00	42.20	41.00	
k5a0.1r1.0	57.00	-9.22	-12.31	45.00	42.00	41.00	42.70	41.40	41.00	
k5a0.3r0.1	144.00	-3.01	-3.99	133.00	130.00	127.00	127.24	122.76	113.50	
k5a0.3r0.3	129.00	-4.05	-4.56	116.00	115.00	113.00	114.70	113.80	112.50	
k5a0.3r0.5	126.00	-3.00	-3.82	115.00	112.00	108.00	111.08	108.80	106.10	
k5a0.3r0.7	123.00	-3.51	-6.25	114.00	109.00	105.00	109.60	106.00	103.00	
k5a0.3r1.0	131.00	-3.64	-4.40	120.00	117.00	112.00	115.68	112.72	108.40	
k5a0.5r0.1	189.00	-1.52	-1.88	180.00	178.00	176.00	176.78	174.32	170.40	
k5a0.5r0.3	186.00	-1.96	-2.13	177.00	175.00	172.00	173.96	171.96	169.40	
k5a0.5r0.5	194.00	-1.77	-2.28	182.00	181.00	178.00	179.42	177.16	173.50	
k5a0.5r0.7	182.00	-2.82	-3.45	172.00	169.00	165.00	168.90	167.00	164.50	
k5a0.5r1.0	180.00	-2.89	-3.29	168.00	166.00	162.00	165.00	163.20	160.00	
k5a0.7r0.1	220.00	-1.60	-1.75	212.00	211.00	209.00	210.50	209.80	209.00	
k5a0.7r0.3	229.00	-1.91	-2.12	219.00	216.00	214.00	216.50	214.80	214.00	
k5a0.7r0.5	222.00	-2.21	-2.42	210.00	209.00	206.00	208.40	207.40	205.50	
k5a0.7r0.7	234.00	-2.31	-2.68	218.00	216.00	214.00	216.00	214.80	214.00	
k5a0.7r1.0	229.00	-3.00	-3.49	213.00	210.00	208.00	210.60	208.80	207.50	
k5a1.0r0.1	273.00	-0.26	-0.50	269.00	267.00	266.00	267.20	266.20	265.00	
k5a1.0r0.3	285.00	-1.58	-1.66	275.00	274.00	273.00	273.70	273.00	272.50	
k5a1.0r0.5	282.00	-0.41	-0.59	276.00	275.00	273.00	274.20	272.72	271.00	
k5a1.0r0.7	293.00	-1.46	-1.74	282.00	280.00	277.00	279.58	277.44	274.50	
k5a1.0r1.0	285.00	-1.86	-2.15	274.00	272.00	269.00	271.24	269.48	267.50	
k7a0.1r0.1	85.00	-8.07	-11.23	68.00	66.00	65.00	66.70	65.60	65.00	

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Instance	BR-FF-VND			Sim BR-FF-VND (1.0)			VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%			
k7a0.1r0.3	91.00	-7.22	-9.56	72.00	69.00	63.00	65.30	59.56	47.30			
k7a0.1r0.5	82.00	-8.36	-9.69	68.00	67.00	65.00	66.60	66.00	64.50			
k7a0.1r0.7	76.00	-8.91	-10.65	60.00	58.00	55.00	55.84	52.44	45.70			
k7a0.1r1.0	72.00	-8.04	-9.12	58.00	57.00	57.00	57.30	56.60	56.00			
k7a0.3r0.1	169.00	-3.45	-4.49	156.00	154.00	153.00	154.30	153.00	151.50			
k7a0.3r0.3	187.00	-4.19	-4.50	171.00	170.00	167.00	169.10	168.00	166.50			
k7a0.3r0.5	165.00	-3.43	-4.82	149.00	147.00	144.00	146.40	145.00	143.00			
k7a0.3r0.7	171.00	-4.40	-5.16	151.00	150.00	147.00	149.30	148.00	147.00			
k7a0.3r1.0	155.00	-4.39	-5.32	140.00	139.00	136.00	138.10	136.60	135.00			
k7a0.5r0.1	247.00	-2.54	-2.72	231.00	229.00	227.00	228.60	227.00	225.00			
k7a0.5r0.3	256.00	-2.50	-2.70	239.00	238.00	234.00	237.20	235.60	234.00			
k7a0.5r0.5	234.00	-3.10	-3.50	219.00	216.00	213.00	215.06	212.92	210.50			
k7a0.5r0.7	244.00	-2.66	-2.95	228.00	226.00	220.00	223.50	220.40	216.50			
k7a0.5r1.0	257.00	-3.44	-3.74	239.00	236.00	230.00	235.10	232.60	229.00			
k7a0.7r0.1	282.00	-1.71	-1.96	269.00	268.00	265.00	267.10	265.60	263.50			
k7a0.7r0.3	307.00	-2.44	-2.76	289.00	288.00	282.00	285.60	282.80	277.00			
k7a0.7r0.5	307.00	-1.17	-1.84	293.00	289.00	285.00	288.46	285.52	281.90			
k7a0.7r0.7	302.00	-2.24	-3.01	284.00	282.00	278.00	281.40	279.80	278.00			
k7a0.7r1.0	298.00	-2.24	-2.48	285.00	283.00	280.00	282.00	280.16	277.40			
k7a1.0r0.1	395.00	-1.16	-1.37	385.00	384.00	383.00	383.80	383.00	382.00			
k7a1.0r0.3	351.00	-0.67	-0.84	345.00	344.00	343.00	343.58	342.84	341.90			
k7a1.0r0.5	344.00	-1.33	-1.55	335.00	334.00	332.00	333.38	332.16	330.90			
k7a1.0r0.7	355.00	-1.41	-1.71	344.00	342.00	341.00	342.30	341.00	340.50			
k7a1.0r1.0	331.00	-1.06	-1.21	324.00	322.00	322.00	322.50	321.60	321.00			
k10a0.1r0.1	108.00	-5.45	-8.35	93.00	91.00	87.00	90.50	88.60	86.50			
k10a0.1r0.3	111.00	-7.68	-9.68	88.00	85.00	81.00	83.20	79.80	74.00			
k10a0.1r0.5	121.00	-6.50	-8.68	103.00	94.00	84.00	95.10	89.20	84.00			
k10a0.1r0.7	96.00	-7.54	-8.05	79.00	77.00	73.00	76.40	74.60	72.50			
k10a0.1r1.0	97.00	-6.54	-8.16	82.00	79.00	75.00	78.50	76.60	74.00			
k10a0.3r0.1	255.00	-4.25	-4.85	229.00	225.00	221.00	225.50	222.20	220.00			
k10a0.3r0.3	234.00	-3.64	-5.57	214.00	209.00	204.00	207.86	203.84	199.70			
k10a0.3r0.5	224.00	-4.75	-5.25	199.00	196.00	194.00	194.90	192.60	189.00			
k10a0.3r0.7	220.00	-4.24	-5.43	194.00	188.00	185.00	188.80	185.80	184.50			
k10a0.3r1.0	239.00	-5.37	-6.78	213.00	208.00	205.00	208.90	206.40	205.00			
k10a0.5r0.1	365.00	-2.21	-2.49	345.00	341.00	335.00	338.16	333.40	324.80			
k10a0.5r0.3	335.00	-2.58	-3.01	314.00	310.00	306.00	310.20	306.80	303.50			
k10a0.5r0.5	324.00	-3.18	-3.51	297.00	291.00	290.00	292.00	289.60	288.50			
k10a0.5r0.7	319.00	-3.16	-3.43	298.00	294.00	291.00	293.80	291.40	289.00			
k10a0.5r1.0	318.00	-3.44	-3.84	296.00	288.00	285.00	290.50	286.00	284.00			
k10a0.7r0.1	434.00	-1.84	-2.11	417.00	413.00	409.00	412.80	409.20	406.00			
k10a0.7r0.3	444.00	-2.39	-2.64	421.00	416.00	411.00	415.02	410.96	407.20			
k10a0.7r0.5	426.00	-2.75	-3.07	403.00	401.00	392.00	397.80	393.40	390.00			
k10a0.7r0.7	394.00	-2.53	-2.93	369.00	361.00	359.00	362.90	359.20	357.00			

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Instance	BR-FF-VND	Sim BR-FF-VND (1.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k10a0.7r1.0	417.00	-2.76	-3.10	394.00	392.00	386.00	390.30	387.40	384.00
k10a1.0r0.1	572.00	-1.15	-1.34	554.00	552.00	547.00	550.50	547.80	544.00
k10a1.0r0.3	517.00	-1.03	-1.09	505.00	502.00	499.00	502.20	500.20	498.50
k10a1.0r0.5	478.00	-1.54	-1.78	462.00	460.00	459.00	460.20	459.20	458.50
k10a1.0r0.7	530.00	-1.45	-1.67	510.00	507.00	505.00	506.80	505.00	503.50
k10a1.0r1.0	472.00	-1.46	-1.52	459.00	457.00	452.00	456.70	454.60	451.50
Average	167.15	-3.19	-3.90						

Table 1.12: Relative deviations for the Simheuristic best solutions (DevBest %) and average of best solutions (AvgDev %) with a level of uncertainty equal to 2.0 to the BR-FF-VND with 1 minute stop time criterion and the Value at Risk ($VaR\alpha$) and Conditional-Value-at-Risk ($CVaR\alpha$) with three levels of confidence (95%, 97.5% and 99%) of the Simheuristic best solution

1.2.3

Results from Sim BR-FF-VND in a PFSPDPST and the deterministic BR-FF-VND in a stochastic environment

On this Section the results aforementioned in Figure 5.4 are illustrated. Each Table contains the 150 instances mentioned in Section 5.1. For each instance, the best solution provided by Sim BR-FF-VND in a PFSPDPST and their deviation with the proposed deterministic BR-FF-VND in a stochastic environment were shown.

Level of Uncertainty	0.1		0.5	
Instance	Sim BR-FF-VND	DevBest (%)	Sim BR-FF-VND	DevBest (%)
k1a0.1r0.1	20.99	-0.04	20.78	-0.30
k1a0.1r0.3	22.04	-0.16	21.94	-0.62
k1a0.1r0.5	20.98	-0.08	20.64	-0.19
k1a0.1r0.7	16.96	-0.08	16.63	-0.13
k1a0.1r1.0	20.00	-0.14	19.77	0.00
k1a0.3r0.1	45.99	-0.02	45.66	-0.09
k1a0.3r0.3	45.72	-1.36	45.08	-0.07
k1a0.3r0.5	46.08	-0.16	45.83	0.00
k1a0.3r0.7	47.00	-0.02	46.65	0.00
k1a0.3r1.0	44.00	-0.06	43.81	-0.31
k1a0.5r0.1	65.01	-0.01	64.82	-0.09
k1a0.5r0.3	63.28	-0.04	62.96	0.00
k1a0.5r0.5	67.14	0.31	67.01	-0.02

k1a0.5r0.7	65.13	-0.19	64.90	0.13
k1a0.5r1.0	59.98	-0.07	59.55	-0.48
k1a0.7r0.1	81.00	0.00	80.71	-0.05
k1a0.7r0.3	81.02	-0.02	80.77	-0.07
k1a0.7r0.5	80.02	-0.02	79.80	-0.17
k1a0.7r0.7	79.00	-0.02	78.78	-0.42
k1a0.7r1.0	78.99	0.00	78.68	0.00
k1a1.0r0.1	99.20	0.04	99.11	-0.02
k1a1.0r0.3	99.00	0.00	98.77	-0.06
k1a1.0r0.5	99.24	0.00	99.16	0.00
k1a1.0r0.7	97.99	-0.02	97.70	-0.03
k1a1.0r1.0	97.77	0.00	96.96	-0.35
k2a0.1r0.1	28.98	0.00	28.70	0.00
k2a0.1r0.3	29.97	0.00	29.67	0.00
k2a0.1r0.5	27.77	-0.30	26.92	-1.33
k2a0.1r0.7	29.80	-0.19	29.05	-0.21
k2a0.1r1.0	25.96	-0.12	25.51	0.00
k2a0.3r0.1	71.82	0.00	70.88	-0.05
k2a0.3r0.3	67.99	-0.01	67.61	-0.41
k2a0.3r0.5	62.33	-0.53	61.61	0.00
k2a0.3r0.7	70.75	0.00	70.10	-0.01
k2a0.3r1.0	64.52	-0.08	63.78	-0.14
k2a0.5r0.1	100.00	-0.05	99.80	-0.38
k2a0.5r0.3	98.00	0.00	97.70	-0.20
k2a0.5r0.5	98.89	-0.04	98.01	0.00
k2a0.5r0.7	93.68	0.16	92.23	0.47
k2a0.5r1.0	86.21	0.72	85.43	-0.09
k2a0.7r0.1	118.01	-0.02	117.17	-0.06
k2a0.7r0.3	114.99	0.00	114.74	-0.20
k2a0.7r0.5	114.00	0.00	113.66	-0.01
k2a0.7r0.7	118.00	0.00	117.66	-0.02
k2a0.7r1.0	110.91	-0.03	109.82	0.16
k2a1.0r0.1	151.00	-0.01	150.78	0.00
k2a1.0r0.3	149.98	-0.02	149.60	-0.05
k2a1.0r0.5	153.99	0.00	153.63	-0.06
k2a1.0r0.7	150.92	-0.03	150.14	0.00
k2a1.0r1.0	141.77	0.00	140.88	-0.07
k3a0.1r0.1	39.84	-0.31	38.90	-0.73
k3a0.1r0.3	31.73	0.08	30.88	-0.01
k3a0.1r0.5	37.81	0.00	36.68	0.75
k3a0.1r0.7	38.56	-0.14	37.84	-0.08
k3a0.1r1.0	35.94	1.66	35.32	-0.01
k3a0.3r0.1	90.98	-0.29	90.06	-0.12
k3a0.3r0.3	92.09	-0.20	90.99	0.00
k3a0.3r0.5	84.79	-0.39	83.49	0.51
k3a0.3r0.7	90.52	-0.04	89.10	-0.07
k3a0.3r1.0	86.40	-0.26	85.49	-0.61

k3a0.5r0.1	127.99	-0.05	127.30	-0.09
k3a0.5r0.3	129.61	0.00	128.21	-0.05
k3a0.5r0.5	125.94	0.00	124.97	0.00
k3a0.5r0.7	127.95	-0.06	127.18	-0.07
k3a0.5r1.0	120.20	-0.27	119.09	-0.39
k3a0.7r0.1	167.99	-0.01	167.34	-0.07
k3a0.7r0.3	160.99	0.00	160.34	-0.11
k3a0.7r0.5	156.97	0.00	156.11	-0.06
k3a0.7r0.7	160.18	0.11	159.58	-0.05
k3a0.7r1.0	158.44	0.00	157.72	-0.01
k3a1.0r0.1	193.92	-0.04	193.25	-0.05
k3a1.0r0.3	168.00	0.00	167.83	-0.02
k3a1.0r0.5	201.95	0.00	201.35	-0.16
k3a1.0r0.7	192.93	-0.06	192.25	-0.29
k3a1.0r1.0	183.59	0.05	182.64	-0.09
k5a0.1r0.1	53.87	0.00	53.00	-0.07
k5a0.1r0.3	56.91	-0.07	55.74	0.00
k5a0.1r0.5	67.44	0.17	66.60	-0.53
k5a0.1r0.7	60.75	0.00	59.46	0.00
k5a0.1r1.0	58.89	-0.02	57.88	-0.09
k5a0.3r0.1	142.99	-0.01	142.00	-0.19
k5a0.3r0.3	128.93	-0.01	127.62	-0.01
k5a0.3r0.5	126.27	-0.01	125.39	0.00
k5a0.3r0.7	122.06	0.00	121.71	0.00
k5a0.3r1.0	130.86	-0.03	129.16	0.13
k5a0.5r0.1	189.96	0.00	188.63	0.00
k5a0.5r0.3	185.99	-0.01	185.06	-0.04
k5a0.5r0.5	194.39	-0.11	193.27	-0.10
k5a0.5r0.7	181.98	-0.01	180.82	-0.15
k5a0.5r1.0	179.98	-0.07	178.89	-0.29
k5a0.7r0.1	219.98	0.00	218.93	0.00
k5a0.7r0.3	228.93	-0.02	227.68	-0.07
k5a0.7r0.5	221.96	0.00	220.83	-0.03
k5a0.7r0.7	233.72	-0.01	231.71	0.09
k5a0.7r1.0	229.58	-0.06	227.81	-0.12
k5a1.0r0.1	274.24	-0.01	273.45	0.00
k5a1.0r0.3	284.74	0.00	283.03	0.00
k5a1.0r0.5	283.37	0.00	282.76	-0.04
k5a1.0r0.7	293.20	-0.10	292.48	-0.22
k5a1.0r1.0	285.71	0.00	283.61	0.00
k7a0.1r0.1	82.15	-0.02	80.62	-0.03
k7a0.1r0.3	94.92	-0.04	93.55	0.00
k7a0.1r0.5	81.01	-2.06	79.67	-2.63
k7a0.1r0.7	76.98	-0.09	75.11	-0.46
k7a0.1r1.0	72.06	0.00	71.07	0.00
k7a0.3r0.1	170.15	-0.07	168.14	-0.14
k7a0.3r0.3	186.00	-0.31	183.72	0.00

k7a0.3r0.5	165.74	0.38	164.11	0.04
k7a0.3r0.7	170.44	-0.15	168.75	0.05
k7a0.3r1.0	155.53	0.00	152.35	0.00
k7a0.5r0.1	247.49	-0.22	245.83	-0.13
k7a0.5r0.3	256.29	-0.05	254.24	0.00
k7a0.5r0.5	233.10	0.00	231.01	-0.02
k7a0.5r0.7	244.76	0.00	242.94	-0.04
k7a0.5r1.0	257.55	-0.37	254.61	-0.19
k7a0.7r0.1	281.90	-0.01	280.62	-0.04
k7a0.7r0.3	306.79	0.11	304.05	0.25
k7a0.7r0.5	307.95	0.00	307.25	-0.41
k7a0.7r0.7	302.41	-0.04	299.77	0.00
k7a0.7r1.0	298.52	-0.21	295.73	0.04
k7a1.0r0.1	394.71	0.00	393.20	0.00
k7a1.0r0.3	350.97	0.02	350.37	0.01
k7a1.0r0.5	344.28	0.00	342.89	0.00
k7a1.0r0.7	354.66	0.00	353.00	0.00
k7a1.0r1.0	330.88	0.00	330.29	0.00
k10a0.1r0.1	108.30	0.00	106.49	0.00
k10a0.1r0.3	109.29	0.00	106.90	0.00
k10a0.1r0.5	121.50	-0.03	118.39	-0.02
k10a0.1r0.7	95.94	-0.02	93.71	-0.12
k10a0.1r1.0	96.76	2.03	94.50	2.94
k10a0.3r0.1	255.93	0.00	253.10	0.00
k10a0.3r0.3	229.88	-0.01	227.18	0.00
k10a0.3r0.5	224.47	-0.10	221.67	-0.02
k10a0.3r0.7	219.69	0.00	216.09	-0.02
k10a0.3r1.0	237.00	-0.02	233.92	-0.09
k10a0.5r0.1	365.38	0.00	362.25	0.00
k10a0.5r0.3	333.64	0.18	331.67	0.27
k10a0.5r0.5	324.64	0.00	321.71	0.00
k10a0.5r0.7	319.38	-0.10	316.46	-0.26
k10a0.5r1.0	317.39	-0.04	313.77	-0.03
k10a0.7r0.1	434.75	-0.01	432.90	-0.10
k10a0.7r0.3	442.51	-0.03	438.85	0.16
k10a0.7r0.5	425.89	-0.01	421.92	-0.04
k10a0.7r0.7	394.23	-0.01	390.35	-0.06
k10a0.7r1.0	416.77	0.00	412.14	0.00
k10a1.0r0.1	572.78	0.00	570.30	-0.04
k10a1.0r0.3	516.71	-0.01	514.98	0.00
k10a1.0r0.5	477.73	0.00	476.28	-0.01
k10a1.0r0.7	531.67	0.00	528.61	0.00
k10a1.0r1.0	471.69	0.00	469.76	0.00
Average	167.18	-0.03	165.93	-0.07

Table 1.13: Relative deviations for the Sim BR-FF-VND best solutions (DevBest %) to deterministic BR-FF-VND in a stochastic environment for different levels of uncertainty (0.1 and 0.5).

Level of Uncertainty	1.0		2.0	
Instance	Sim BR-FF-VND	DevBest (%)	Sim BR-FF-VND	DevBest (%)
k1a0.1r0.1	20.56	-0.12	20.33	-0.04
k1a0.1r0.3	21.70	-0.29	21.44	-0.25
k1a0.1r0.5	20.39	-0.33	19.97	-0.05
k1a0.1r0.7	16.48	-0.22	16.26	-0.23
k1a0.1r1.0	19.59	-0.10	19.25	-0.12
k1a0.3r0.1	45.40	-0.16	44.92	-0.01
k1a0.3r0.3	44.88	-0.08	44.49	-0.15
k1a0.3r0.5	45.52	0.00	45.11	0.00
k1a0.3r0.7	46.29	0.00	45.95	-0.16
k1a0.3r1.0	43.37	-0.02	42.82	-0.19
k1a0.5r0.1	64.59	-0.11	64.23	-0.11
k1a0.5r0.3	62.68	-0.03	62.23	-0.01
k1a0.5r0.5	66.90	-0.07	66.59	-0.06
k1a0.5r0.7	64.58	0.24	64.08	0.11
k1a0.5r1.0	59.06	-0.72	58.32	-0.93
k1a0.7r0.1	80.39	-0.06	80.03	-0.14
k1a0.7r0.3	80.43	-0.07	79.98	-0.05
k1a0.7r0.5	79.45	-0.20	78.98	-0.22
k1a0.7r0.7	78.50	-0.59	78.10	-0.65
k1a0.7r1.0	78.37	0.00	77.87	-0.02
k1a1.0r0.1	98.87	0.00	98.54	0.00
k1a1.0r0.3	98.43	-0.05	98.00	-0.02
k1a1.0r0.5	99.00	0.00	98.70	0.00
k1a1.0r0.7	97.45	0.02	97.15	0.05
k1a1.0r1.0	95.87	0.00	96.13	-1.17
k2a0.1r0.1	28.46	0.00	28.08	0.00
k2a0.1r0.3	29.28	0.00	28.69	0.00
k2a0.1r0.5	26.48	-1.58	25.88	-1.06
k2a0.1r0.7	28.64	-0.61	27.91	-0.67
k2a0.1r1.0	25.20	0.00	24.81	0.00
k2a0.3r0.1	70.39	-0.19	69.85	-0.38
k2a0.3r0.3	67.08	-0.24	66.46	-0.24
k2a0.3r0.5	61.13	-0.18	60.46	-0.22
k2a0.3r0.7	69.64	-0.02	69.06	-0.06
k2a0.3r1.0	63.08	-0.16	62.12	-0.21
k2a0.5r0.1	99.48	-0.56	98.85	-0.59
k2a0.5r0.3	97.12	-0.18	96.41	-0.23

k2a0.5r0.5	97.40	0.00	96.70	0.00
k2a0.5r0.7	91.32	0.64	90.40	0.58
k2a0.5r1.0	84.95	-0.64	83.94	-0.90
k2a0.7r0.1	116.54	-0.08	115.74	-0.05
k2a0.7r0.3	114.27	-0.25	113.67	-0.39
k2a0.7r0.5	113.23	-0.07	112.49	-0.08
k2a0.7r0.7	117.02	0.00	116.26	0.00
k2a0.7r1.0	109.02	0.19	107.92	0.08
k2a1.0r0.1	150.64	0.00	150.42	0.00
k2a1.0r0.3	149.51	-0.11	149.18	-0.05
k2a1.0r0.5	153.21	-0.10	152.51	-0.06
k2a1.0r0.7	149.66	-0.02	149.01	-0.01
k2a1.0r1.0	140.30	-0.08	139.40	-0.05
k3a0.1r0.1	38.05	0.20	37.44	0.11
k3a0.1r0.3	30.49	0.00	30.04	0.00
k3a0.1r0.5	35.82	1.16	35.07	0.42
k3a0.1r0.7	37.28	-0.01	36.63	-0.22
k3a0.1r1.0	34.64	-0.09	33.80	-0.53
k3a0.3r0.1	89.21	0.16	88.15	0.38
k3a0.3r0.3	90.11	0.00	89.17	-0.24
k3a0.3r0.5	83.36	0.00	82.54	-0.12
k3a0.3r0.7	88.18	-0.09	87.05	-0.07
k3a0.3r1.0	84.63	-0.67	83.55	-0.98
k3a0.5r0.1	126.72	-0.11	125.82	-0.10
k3a0.5r0.3	127.19	0.00	125.86	0.00
k3a0.5r0.5	124.18	-0.11	122.91	-0.07
k3a0.5r0.7	126.39	-0.02	125.31	-0.01
k3a0.5r1.0	117.91	-0.42	116.18	-0.42
k3a0.7r0.1	166.69	-0.08	165.76	-0.02
k3a0.7r0.3	159.54	-0.06	158.61	-0.05
k3a0.7r0.5	155.11	0.08	153.96	0.19
k3a0.7r0.7	158.95	-0.10	158.01	-0.29
k3a0.7r1.0	156.76	0.00	154.36	0.73
k3a1.0r0.1	192.80	-0.09	191.89	-0.03
k3a1.0r0.3	167.67	-0.06	167.41	-0.07
k3a1.0r0.5	200.59	-0.12	199.69	-0.11
k3a1.0r0.7	191.52	-0.31	190.46	-0.27
k3a1.0r1.0	181.64	-0.05	180.28	0.06
k5a0.1r0.1	52.38	-0.34	51.34	-0.26
k5a0.1r0.3	55.06	0.00	53.99	-0.05
k5a0.1r0.5	65.59	-0.38	63.94	-0.14
k5a0.1r0.7	58.40	0.00	56.94	0.00
k5a0.1r1.0	56.97	-0.19	55.55	-0.14
k5a0.3r0.1	140.73	-0.23	139.23	-0.24
k5a0.3r0.3	126.24	-0.01	124.37	0.00
k5a0.3r0.5	124.69	-0.07	123.34	-0.06
k5a0.3r0.7	120.80	0.00	119.23	0.00

k5a0.3r1.0	127.73	0.19	126.19	-0.06
k5a0.5r0.1	187.54	-0.13	186.13	-0.25
k5a0.5r0.3	184.00	-0.09	182.75	-0.22
k5a0.5r0.5	192.25	-0.13	190.83	-0.19
k5a0.5r0.7	179.08	0.00	177.25	0.00
k5a0.5r1.0	177.35	-0.20	175.31	-0.12
k5a0.7r0.1	218.03	0.00	216.70	0.00
k5a0.7r0.3	226.42	-0.05	224.73	-0.02
k5a0.7r0.5	219.33	0.00	217.48	-0.02
k5a0.7r0.7	230.45	0.00	229.05	-0.10
k5a0.7r1.0	226.06	-0.13	223.66	-0.19
k5a1.0r0.1	272.82	0.00	272.35	-0.18
k5a1.0r0.3	282.05	0.10	280.76	0.10
k5a1.0r0.5	282.13	-0.02	281.10	0.00
k5a1.0r0.7	291.30	-0.21	289.45	-0.25
k5a1.0r1.0	282.05	0.00	279.98	0.00
k7a0.1r0.1	79.34	0.00	77.85	0.00
k7a0.1r0.3	92.21	-0.04	90.23	-0.09
k7a0.1r0.5	78.37	-2.61	76.47	-2.25
k7a0.1r0.7	73.19	-0.23	71.35	-0.49
k7a0.1r1.0	69.92	-0.01	68.33	-0.04
k7a0.3r0.1	166.33	-0.02	164.25	-0.12
k7a0.3r0.3	182.19	-0.24	180.22	-0.70
k7a0.3r0.5	162.37	-0.06	159.64	0.08
k7a0.3r0.7	166.98	0.04	164.21	-0.16
k7a0.3r1.0	150.37	0.00	148.09	0.00
k7a0.5r0.1	244.18	-0.13	241.68	-0.12
k7a0.5r0.3	252.73	-0.02	250.53	-0.14
k7a0.5r0.5	229.27	-0.10	226.69	-0.14
k7a0.5r0.7	241.21	-0.06	238.49	-0.10
k7a0.5r1.0	252.16	-0.03	248.99	0.08
k7a0.7r0.1	279.42	-0.06	277.51	-0.02
k7a0.7r0.3	302.08	0.32	299.26	0.50
k7a0.7r0.5	305.40	-0.51	302.54	-0.58
k7a0.7r0.7	297.89	-0.02	295.16	-0.02
k7a0.7r1.0	293.63	0.14	290.87	0.30
k7a1.0r0.1	392.00	0.00	389.94	0.00
k7a1.0r0.3	349.81	-0.02	348.94	-0.02
k7a1.0r0.5	341.39	0.00	339.57	-0.02
k7a1.0r0.7	352.15	0.00	350.93	0.00
k7a1.0r1.0	329.55	0.00	328.42	-0.04
k10a0.1r0.1	105.04	-0.13	102.83	-0.07
k10a0.1r0.3	104.78	-0.05	102.02	0.10
k10a0.1r0.5	116.19	0.00	113.60	0.00
k10a0.1r0.7	92.03	-0.07	90.18	-0.15
k10a0.1r1.0	93.14	3.15	92.47	2.04
k10a0.3r0.1	250.51	0.00	246.86	0.00

k10a0.3r0.3	224.54	0.00	221.48	-0.24
k10a0.3r0.5	219.26	-0.02	215.63	0.00
k10a0.3r0.7	213.52	0.00	210.14	0.00
k10a0.3r1.0	230.83	-0.11	226.38	-0.16
k10a0.5r0.1	360.74	-0.30	357.60	-0.39
k10a0.5r0.3	329.44	0.31	327.03	-0.02
k10a0.5r0.5	318.72	0.00	314.86	0.00
k10a0.5r0.7	313.75	-0.28	309.70	-0.13
k10a0.5r1.0	311.05	-0.07	307.21	-0.12
k10a0.7r0.1	430.87	-0.18	428.13	-0.36
k10a0.7r0.3	437.48	-0.12	434.05	-0.21
k10a0.7r0.5	418.51	-0.04	414.41	-0.04
k10a0.7r0.7	387.97	-0.13	384.49	-0.12
k10a0.7r1.0	408.41	0.00	404.86	-0.22
k10a1.0r0.1	567.94	0.01	564.55	0.02
k10a1.0r0.3	513.54	0.04	511.99	-0.01
k10a1.0r0.5	474.76	0.00	472.40	0.00
k10a1.0r0.7	525.62	0.00	521.46	0.03
k10a1.0r1.0	468.24	0.00	466.00	0.00
Average	164.85	-0.08	163.38	-0.11

Table 1.14: Relative deviations for the Sim BR-FF-VND best solutions (DevBest %) to deterministic BR-FF-VND in a stochastic environment for different levels of uncertainty (1.0 and 2.0).

1.2.4

Results from Sim BR-FF-VND in a PFSPDPST and a Sim BR-FF-VND in a PFSPST

On this Section the results aforementioned in Figure 5.9 are illustrated. Each Table contains the 150 instances mentioned in Section 5.1. For each instance, the best solution provided by Sim BR-FF-VND in a PFSPST and their deviation with proposed Sim BR-FF-VND in a PFSPSPST were shown. Moreover, the deviation of the Value at Risk (VaR_α) and Conditional Value at Risk ($CVaR_\alpha$) of the best stochastic solution were illustrated with for three different levels of confidence.

Instance	PFSPDPST		PFSPSTRD			Dev(%)				
	Sim BR-FF-VND (0.1)		Sim BR-FF-VND (0.1)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)		95%	97.5%	99%	95%	97.5%	99%
k1a0.1r0.1	20.99	0.02	-0.51		0.00	0.00	5.00	0.48	0.97	2.50

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Instance	PFSPDPST	PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (0.1)	Sim BR-FF-VND (0.1)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k1a0.1r0.3	22.00	0.00	-0.03	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.1r0.5	20.98	-0.10	-0.05	0.00	-4.76	0.00	-2.13	-2.16	-0.50
k1a0.1r0.7	17.00	-0.02	-0.15	0.00	0.00	0.00	-0.47	-0.95	-2.41
k1a0.1r1.0	19.98	-0.10	-0.22	0.00	-5.00	0.00	-2.03	-2.06	0.00
k1a0.3r0.1	45.99	-0.01	-0.04	0.00	0.00	0.00	-0.17	-0.35	0.22
k1a0.3r0.3	45.60	-0.08	0.00	0.00	-2.22	-2.22	-1.38	-2.22	-2.22
k1a0.3r0.5	46.05	-0.11	-0.02	0.00	4.55	4.55	3.60	4.55	4.55
k1a0.3r0.7	46.99	-0.01	-0.04	0.00	0.00	0.00	-0.13	-0.26	-0.65
k1a0.3r1.0	44.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.5r0.1	65.00	-0.01	-0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.5r0.3	62.99	0.04	-0.00	0.00	-1.59	-1.59	-1.02	-1.15	-0.48
k1a0.5r0.5	67.12	0.19	0.03	0.00	0.00	-1.49	-0.45	-0.90	-2.24
k1a0.5r0.7	65.88	0.02	-0.13	0.00	0.00	0.00	0.22	0.00	0.00
k1a0.5r1.0	59.99	-0.03	0.02	0.00	0.00	-1.67	-0.60	-1.20	-2.35
k1a0.7r0.1	81.00	-0.01	0.11	0.00	0.00	0.00	-0.12	-0.25	-0.62
k1a0.7r0.3	81.04	-0.01	-0.00	0.00	1.25	0.00	0.37	0.05	-0.38
k1a0.7r0.5	80.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.7r0.7	79.03	-0.01	-0.01	0.00	1.28	1.28	0.64	1.03	0.64
k1a0.7r1.0	78.98	-0.04	-0.07	-1.27	-1.27	0.00	-0.89	-0.51	0.00
k1a1.0r0.1	99.11	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
k1a1.0r0.3	99.00	-0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
k1a1.0r0.5	99.29	-0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
k1a1.0r0.7	97.99	-0.01	-0.03	0.00	0.00	0.00	-0.10	-0.20	0.00
k1a1.0r1.0	97.77	-0.78	-0.20	0.00	1.04	1.04	0.85	1.17	1.36
k2a0.1r0.1	28.98	0.03	0.80	0.00	0.00	3.57	0.63	1.28	2.57
k2a0.1r0.3	29.89	0.10	1.16	0.00	0.00	0.00	-0.34	-0.69	-1.72
k2a0.1r0.5	27.95	-0.05	-0.46	-3.57	0.00	3.85	0.00	2.27	3.85
k2a0.1r0.7	29.95	-0.07	-0.34	0.00	0.00	0.00	0.00	0.00	0.00
k2a0.1r1.0	26.88	-3.56	-2.11	-3.85	-3.85	-11.54	-5.48	-7.12	-10.16
k2a0.3r0.1	71.89	-0.03	0.10	0.00	0.00	-1.41	-0.51	-1.02	-1.42
k2a0.3r0.3	67.98	-0.01	-0.04	0.00	0.00	0.00	-0.15	-0.30	-0.75
k2a0.3r0.5	62.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
k2a0.3r0.7	71.26	0.05	-0.00	-1.41	0.00	0.00	-0.11	0.23	0.58
k2a0.3r1.0	63.98	0.25	-0.56	-1.56	-1.56	-1.59	-1.51	-1.46	-2.22
k2a0.5r0.1	100.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
k2a0.5r0.3	98.13	-0.13	-0.02	0.00	0.00	0.00	0.14	0.29	0.72
k2a0.5r0.5	98.97	-0.28	-0.36	-2.02	-2.02	-1.03	-1.63	-1.23	-1.55
k2a0.5r0.7	93.98	-0.08	-0.04	-1.06	-1.06	-1.08	-0.94	-0.82	-0.97
k2a0.5r1.0	86.38	0.00	-0.02	0.00	-1.16	0.00	-0.75	-0.80	-0.82
k2a0.7r0.1	118.02	0.01	-0.00	0.00	0.00	-0.85	-0.08	-0.17	-0.43
k2a0.7r0.3	114.99	0.02	-0.00	0.00	0.00	-0.87	-0.12	-0.24	-0.18

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Instance	PFSPDPST	PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (0.1)	Sim BR-FF-VND (0.1)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k2a0.7r0.5	114.38	-0.34	-0.04	0.00	0.88	0.89	0.83	1.18	1.53
k2a0.7r0.7	118.00	-0.01	-0.10	0.00	0.00	-0.85	-0.22	-0.44	-0.51
k2a0.7r1.0	110.95	0.01	-0.02	0.00	0.91	-0.91	0.16	-0.33	-0.82
k2a1.0r0.1	150.99	0.00	-0.00	0.00	0.00	0.00	0.08	0.16	0.40
k2a1.0r0.3	150.00	-0.00	-0.02	0.00	0.00	0.00	-0.04	-0.08	-0.20
k2a1.0r0.5	153.99	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
k2a1.0r0.7	150.70	0.10	0.03	0.00	0.00	0.00	0.04	0.08	0.20
k2a1.0r1.0	141.79	-0.10	-0.21	0.00	0.00	0.00	-0.23	-0.14	-0.36
k3a0.1r0.1	39.04	0.06	-0.39	0.00	0.00	0.00	0.21	0.42	0.00
k3a0.1r0.3	32.66	0.03	-0.96	0.00	0.00	0.00	-0.97	-1.94	-4.84
k3a0.1r0.5	37.81	-0.30	0.03	0.00	-2.78	-5.56	-1.95	-3.91	-4.23
k3a0.1r0.7	38.76	0.35	-0.02	0.00	0.00	0.00	0.00	0.00	0.00
k3a0.1r1.0	35.94	-0.26	-0.27	0.00	0.00	0.00	-1.09	-2.20	-2.35
k3a0.3r0.1	90.92	0.08	-0.86	1.11	0.00	1.12	0.27	0.27	0.34
k3a0.3r0.3	92.13	-0.09	0.07	0.00	0.00	0.00	-0.49	-0.40	-1.00
k3a0.3r0.5	85.38	-0.71	-0.32	0.00	1.20	1.20	0.84	1.45	1.82
k3a0.3r0.7	90.48	-0.03	-0.09	0.00	0.00	0.00	-0.05	-0.09	-0.34
k3a0.3r1.0	87.27	-1.06	-0.99	-2.30	-1.16	-1.18	-1.40	-1.40	-1.18
k3a0.5r0.1	127.97	0.02	0.00	0.79	0.00	-0.79	0.16	-0.16	-0.40
k3a0.5r0.3	129.54	-0.13	-0.01	0.00	0.00	-0.78	-0.06	-0.13	-0.31
k3a0.5r0.5	125.89	-0.02	0.05	0.00	0.00	0.00	-0.08	-0.16	-0.40
k3a0.5r0.7	127.90	0.05	-0.03	0.79	0.00	0.00	0.28	0.09	0.24
k3a0.5r1.0	119.94	0.22	-0.20	0.84	0.00	-0.84	0.08	-0.51	-0.42
k3a0.7r0.1	168.00	-0.01	-0.00	0.00	-0.60	0.00	-0.06	-0.12	0.00
k3a0.7r0.3	161.59	0.05	0.01	0.00	0.00	-0.63	-0.19	-0.18	-0.44
k3a0.7r0.5	156.97	-0.03	0.02	-0.64	0.00	-0.64	-0.50	-0.36	-0.64
k3a0.7r0.7	160.42	0.01	-0.05	0.00	0.00	-0.62	-0.06	-0.13	-0.06
k3a0.7r1.0	158.23	-0.03	-0.07	-0.64	0.00	0.00	-0.23	-0.15	-0.39
k3a1.0r0.1	194.00	-0.04	-0.01	-0.52	-0.52	-0.52	-0.47	-0.43	-0.31
k3a1.0r0.3	168.00	0.00	-0.00	0.00	0.00	0.00	0.06	0.12	0.30
k3a1.0r0.5	201.91	0.04	-0.01	0.50	0.00	0.00	0.27	0.08	0.20
k3a1.0r0.7	192.90	-0.01	-0.03	-0.52	0.00	0.00	-0.17	-0.02	-0.05
k3a1.0r1.0	183.90	-0.54	-0.06	-0.55	-0.55	-0.55	-0.56	-0.57	-0.60
k5a0.1r0.1	54.34	-2.75	-1.33	-7.55	-9.43	-11.32	-9.06	-10.19	-11.32
k5a0.1r0.3	58.37	-1.30	-3.65	-1.75	-1.75	0.00	-1.84	-1.93	-0.37
k5a0.1r0.5	68.95	-0.16	-2.11	-2.90	-2.94	-2.99	-2.77	-3.50	-4.03
k5a0.1r0.7	60.84	-0.42	-0.65	-3.33	-3.39	-7.02	-4.59	-6.21	-9.65
k5a0.1r1.0	58.07	-1.34	-0.90	-1.79	-3.57	-3.64	-3.81	-5.49	-7.82
k5a0.3r0.1	143.95	0.00	0.00	-0.69	0.00	0.70	0.10	0.51	0.92
k5a0.3r0.3	129.17	-0.20	-0.37	0.78	0.00	0.79	0.16	0.13	0.32
k5a0.3r0.5	126.20	-0.04	-0.01	0.00	0.00	0.00	0.16	0.32	0.00

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Instance	PFSPDPST	PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (0.1)	Sim BR-FF-VND (0.1)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k5a0.3r0.7	122.92	0.01	-0.27	-0.82	-0.83	0.00	-0.33	-0.33	0.42
k5a0.3r1.0	131.25	-0.02	-0.03	0.77	0.00	0.00	0.00	-0.15	-0.38
k5a0.5r0.1	189.93	-0.06	0.04	-0.53	-0.53	-2.12	-0.79	-1.06	-1.60
k5a0.5r0.3	186.12	-0.05	-0.02	0.54	0.54	0.54	0.52	0.50	0.44
k5a0.5r0.5	194.35	0.23	0.05	0.00	-0.52	0.00	-0.16	-0.10	0.00
k5a0.5r0.7	182.00	-0.01	-0.07	0.00	0.00	0.00	-0.12	-0.24	-0.28
k5a0.5r1.0	181.06	-0.53	-0.24	-0.56	-0.56	-1.11	-0.71	-0.87	-1.11
k5a0.7r0.1	220.03	-0.05	-0.02	0.00	0.46	0.46	0.50	0.64	0.92
k5a0.7r0.3	228.99	-0.02	-0.02	-0.44	-0.44	0.00	-0.33	-0.23	-0.13
k5a0.7r0.5	221.84	-0.15	-0.44	-0.45	-0.90	-0.45	-0.54	-0.60	-0.64
k5a0.7r0.7	233.81	-0.06	-0.13	-0.43	-0.43	-0.43	-0.42	-0.62	-0.69
k5a0.7r1.0	230.09	-0.13	-0.09	0.00	-0.88	-0.44	-0.46	-0.56	-0.18
k5a1.0r0.1	274.18	-0.14	-0.03	0.00	0.00	0.00	0.00	0.00	0.00
k5a1.0r0.3	284.68	-0.01	0.01	0.35	0.00	0.35	0.18	0.21	0.36
k5a1.0r0.5	283.66	-0.01	0.07	0.00	-0.35	0.00	-0.02	-0.01	0.00
k5a1.0r0.7	293.05	-0.02	-0.06	0.00	0.00	0.00	-0.03	-0.07	-0.17
k5a1.0r1.0	285.75	-0.14	-0.26	-0.35	-0.70	-0.35	-0.53	-0.63	-0.88
k7a0.1r0.1	84.86	-0.58	-2.96	-1.19	-1.20	-1.20	-1.56	-1.45	-1.81
k7a0.1r0.3	91.39	-0.33	-0.30	0.00	0.00	-1.12	-0.45	-0.45	-1.13
k7a0.1r0.5	81.94	-0.10	0.49	0.00	-1.23	0.00	-0.47	-0.20	0.64
k7a0.1r0.7	77.01	-0.36	0.29	0.00	0.00	1.37	0.13	0.54	1.38
k7a0.1r1.0	73.15	-2.12	-1.86	-5.56	-4.29	-4.29	-4.46	-3.91	-3.33
k7a0.3r0.1	169.58	-0.54	0.55	-0.60	0.60	0.60	0.12	0.60	0.60
k7a0.3r0.3	187.35	0.03	-0.20	0.54	0.00	0.55	0.30	0.44	1.04
k7a0.3r0.5	165.52	0.19	0.05	0.00	0.61	-0.61	-0.06	-0.12	-0.62
k7a0.3r0.7	171.09	0.09	-0.12	0.00	-0.59	0.00	-0.26	-0.40	-0.71
k7a0.3r1.0	154.04	0.48	-0.13	0.00	0.00	0.00	-0.07	-0.13	-0.34
k7a0.5r0.1	248.34	-0.44	-0.06	-0.40	0.41	0.00	0.20	0.49	0.83
k7a0.5r0.3	256.50	-0.05	-0.04	0.79	0.40	0.40	0.59	0.63	0.60
k7a0.5r0.5	232.87	0.30	0.02	0.00	0.00	0.00	-0.14	-0.12	0.04
k7a0.5r0.7	244.74	-0.14	-0.02	-0.41	-0.41	-0.41	-0.48	-0.55	-0.83
k7a0.5r1.0	256.86	-0.02	-0.03	0.00	0.00	0.00	-0.15	-0.19	-0.47
k7a0.7r0.1	282.54	-0.26	-0.15	0.00	0.00	-1.07	-0.36	-0.54	-0.82
k7a0.7r0.3	306.71	0.05	0.12	0.00	-0.33	0.00	-0.26	-0.40	-0.83
k7a0.7r0.5	308.69	0.04	-0.01	0.00	-0.33	-0.65	-0.22	-0.31	-0.66
k7a0.7r0.7	301.79	-0.01	-0.05	0.00	0.00	-0.33	-0.11	-0.23	-0.27
k7a0.7r1.0	298.90	-0.21	0.00	-0.34	0.00	0.00	-0.17	-0.08	0.10
k7a1.0r0.1	394.86	-0.01	-0.01	0.00	0.00	-0.25	-0.10	-0.20	-0.25
k7a1.0r0.3	351.09	-0.05	0.01	-0.28	-0.29	-0.29	-0.35	-0.38	-0.51
k7a1.0r0.5	343.94	-0.07	-0.04	-0.29	-0.29	0.00	-0.20	-0.11	-0.12
k7a1.0r0.7	354.57	-0.01	-0.08	0.00	0.00	0.00	0.01	0.01	-0.06

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Instance	PFSPDPST	PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (0.1)	Sim BR-FF-VND (0.1)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k7a1.0r1.0	330.87	-0.00	-0.00	0.00	0.00	0.00	0.00	0.00	0.00
k10a0.1r0.1	110.16	-1.35	-2.20	-0.93	-0.93	-0.94	-1.03	-1.13	-1.43
k10a0.1r0.3	109.08	1.93	0.58	4.76	5.83	5.88	5.23	5.47	4.93
k10a0.1r0.5	121.24	-1.01	-0.68	-1.68	-1.71	-2.56	-1.79	-2.06	-2.16
k10a0.1r0.7	95.96	-0.04	0.12	-1.06	0.00	-2.17	-0.74	-1.00	-1.43
k10a0.1r1.0	98.82	-2.04	-0.30	-3.09	-4.12	-4.17	-3.83	-4.16	-4.17
k10a0.3r0.1	256.23	-0.60	-0.55	0.00	0.40	0.00	0.12	0.16	0.00
k10a0.3r0.3	235.54	-0.58	-0.31	-0.43	0.00	-0.43	-0.39	-0.43	-0.64
k10a0.3r0.5	224.56	-0.05	-0.07	0.00	-0.45	0.00	-0.31	-0.45	-0.36
k10a0.3r0.7	219.57	0.57	0.06	0.46	0.00	-0.47	0.22	0.00	-0.37
k10a0.3r1.0	235.68	1.15	-0.12	1.72	2.17	1.30	1.58	1.66	1.48
k10a0.5r0.1	364.95	0.13	0.06	-0.27	-0.82	-0.83	-0.74	-1.05	-1.38
k10a0.5r0.3	335.52	-0.09	-0.17	-0.30	0.00	-0.30	-0.17	-0.33	-0.57
k10a0.5r0.5	324.13	-0.22	-0.30	-0.31	-0.31	-0.31	-0.37	-0.44	-0.50
k10a0.5r0.7	320.62	-0.19	-0.25	-0.31	-0.32	-0.32	-0.30	-0.37	-0.51
k10a0.5r1.0	318.54	-0.06	-0.07	0.00	-0.32	-0.32	-0.29	-0.37	-0.45
k10a0.7r0.1	434.58	-0.03	-0.04	0.00	0.00	-0.23	-0.05	-0.03	-0.07
k10a0.7r0.3	442.94	0.15	-0.01	0.45	0.46	0.46	0.38	0.36	0.23
k10a0.7r0.5	425.40	-0.02	0.07	0.00	-0.47	-0.24	-0.28	-0.33	-0.24
k10a0.7r0.7	394.48	-0.16	-0.13	-0.25	0.00	-0.26	-0.15	-0.20	-0.51
k10a0.7r1.0	416.05	0.02	0.16	-0.48	-0.48	-0.48	-0.42	-0.54	-0.75
k10a1.0r0.1	572.55	-0.06	-0.00	0.00	0.00	0.00	0.03	0.05	-0.02
k10a1.0r0.3	516.57	-0.00	-0.03	0.00	0.19	0.00	0.04	0.07	0.08
k10a1.0r0.5	477.83	-0.01	-0.14	-0.21	-0.42	-0.42	-0.32	-0.38	-0.32
k10a1.0r0.7	531.44	-0.10	-0.10	-0.19	-0.19	-0.19	-0.13	-0.08	-0.02
k10a1.0r1.0	472.76	-0.21	-0.05	-0.21	0.00	0.00	-0.09	0.04	0.11
Average	167.34	-0.15	-0.18						

Table 1.15: Relative deviations for the Simheuristic best solutions (DevBest %). average of best solutions (AvgDev %). Value at Risk ($VaR\alpha$) and Conditional-Value-at-Risk (CVaR α) with three levels of confidence (95%. 97.5% and 99%) in a PFSPDPST to a Simheuristic Sim BR-FF-VND in a PFSPDST with 1 minute stop time criterion and level of uncertainty of 0.1.

Instance	PFSPDPST	PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (0.5)	Sim BR-FF-VND (0.5)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k1a0.1r0.1	20.79	-0.26	-0.76	0.00	-5.00	0.00	-1.52	-2.06	0.00
k1a0.1r0.3	21.84	-0.50	-0.42	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.1r0.5	20.73	-0.43	-0.30	-5.00	0.00	0.00	-2.06	0.00	0.00
k1a0.1r0.7	16.77	-0.35	-0.46	0.00	0.00	0.00	-1.52	-3.08	0.00
k1a0.1r1.0	19.78	0.05	-0.71	0.00	0.00	0.00	0.53	1.06	2.70
k1a0.3r0.1	45.70	-0.33	-0.14	-2.22	-2.22	2.33	-1.12	0.00	2.33
k1a0.3r0.3	45.03	-0.19	-0.06	0.00	0.00	0.00	-0.14	-0.27	-0.68
k1a0.3r0.5	45.84	-0.08	-0.20	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.7	46.77	-0.17	-0.31	0.00	-2.17	0.00	-0.88	-0.44	0.00
k1a0.3r1.0	43.87	-0.21	-0.10	0.00	-2.33	0.00	-1.18	-1.44	0.00
k1a0.5r0.1	64.81	-0.03	-0.03	0.00	-1.56	0.00	-0.47	-0.94	0.00
k1a0.5r0.3	62.73	0.03	-0.08	0.00	1.64	0.00	0.23	0.39	0.16
k1a0.5r0.5	67.00	-0.01	0.00	0.00	1.52	0.00	0.76	0.91	0.00
k1a0.5r0.7	64.98	-0.04	-0.19	-1.54	0.00	0.00	-0.78	0.00	0.00
k1a0.5r1.0	59.62	-0.75	-0.24	-1.69	-1.72	0.00	-1.42	-0.84	0.53
k1a0.7r0.1	80.67	0.01	0.03	0.00	0.00	-1.27	-0.56	-1.11	-1.27
k1a0.7r0.3	80.85	-0.06	-0.10	-1.25	0.00	0.00	-0.20	-0.15	-0.38
k1a0.7r0.5	79.79	0.04	-0.02	-1.27	-1.27	0.00	-0.79	-0.31	-0.13
k1a0.7r0.7	78.73	-0.01	-0.05	0.00	0.00	0.00	0.13	0.26	0.13
k1a0.7r1.0	78.58	0.15	-0.10	1.30	0.00	1.32	0.13	0.00	-0.66
k1a1.0r0.1	99.03	-0.07	-0.06	0.00	0.00	0.00	0.00	0.00	0.00
k1a1.0r0.3	98.84	-0.05	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
k1a1.0r0.5	99.18	-0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00
k1a1.0r0.7	97.78	-0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00
k1a1.0r1.0	96.92	-0.12	-0.25	0.00	0.00	0.00	0.00	0.00	-0.42
k2a0.1r0.1	28.61	0.21	0.76	0.00	0.00	0.00	0.98	1.99	1.17
k2a0.1r0.3	29.39	0.10	0.52	0.00	0.00	-3.57	-1.07	-2.14	-3.57
k2a0.1r0.5	27.42	0.13	-1.59	0.00	-4.00	-4.00	-2.00	-4.00	-4.00
k2a0.1r0.7	29.39	-0.14	-0.85	-3.57	0.00	-3.70	-1.47	-1.48	-3.70
k2a0.1r1.0	26.25	-4.53	-3.51	-4.17	-4.17	4.55	-1.72	0.88	2.27
k2a0.3r0.1	70.82	0.09	-0.03	0.00	-1.45	0.00	-0.99	-1.22	-0.88
k2a0.3r0.3	67.42	-0.15	-0.06	-1.52	0.00	0.00	-0.46	-0.31	-0.77
k2a0.3r0.5	61.71	-0.28	-0.10	0.00	-1.67	0.00	-0.67	0.00	0.85
k2a0.3r0.7	70.47	-0.12	-0.26	0.00	0.00	0.00	-0.06	-0.12	-0.29
k2a0.3r1.0	63.34	-0.34	-0.80	-1.64	-1.64	-1.64	-1.64	-1.64	-1.65
k2a0.5r0.1	99.87	-0.05	-0.19	-1.01	-1.01	-1.02	-1.20	-1.38	-1.43
k2a0.5r0.3	97.91	-0.30	-0.17	0.00	-1.04	1.06	0.02	0.04	0.53
k2a0.5r0.5	98.35	-0.75	-0.35	0.00	0.00	1.06	-0.06	0.42	1.06
k2a0.5r0.7	92.97	0.00	-0.09	0.00	0.00	1.12	0.36	0.72	1.12
k2a0.5r1.0	85.94	-0.11	0.02	0.00	-1.18	-2.35	-1.06	-1.84	-2.49
k2a0.7r0.1	117.25	-0.06	-0.10	-0.86	0.00	-0.87	-0.47	-0.35	-0.44

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Instance	PFSPDPST	PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (0.5)	Sim BR-FF-VND (0.5)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k2a0.7r0.3	114.55	0.14	0.07	0.00	0.89	0.00	0.37	0.57	0.36
k2a0.7r0.5	113.57	-0.11	-0.12	0.00	0.00	0.91	0.18	0.36	1.37
k2a0.7r0.7	117.67	-0.29	-0.14	-0.86	0.00	0.00	-0.38	-0.14	-0.35
k2a0.7r1.0	110.07	-0.18	-0.19	-0.92	-1.83	0.00	-1.20	-0.74	-0.47
k2a1.0r0.1	150.75	0.00	-0.02	0.00	0.00	0.68	0.27	0.54	0.68
k2a1.0r0.3	149.81	-0.25	-0.17	-0.67	-0.67	0.00	-0.54	-0.40	0.00
k2a1.0r0.5	153.62	0.01	0.11	0.00	0.66	0.00	0.20	0.40	0.67
k2a1.0r0.7	150.01	0.01	-0.03	0.00	0.00	0.00	-0.05	-0.11	0.00
k2a1.0r1.0	141.00	-0.22	-0.21	0.00	0.00	-0.72	-0.07	-0.14	-0.36
k3a0.1r0.1	38.78	-0.57	-1.33	-2.70	0.00	-2.78	-1.92	-1.67	-4.17
k3a0.1r0.3	31.91	-0.08	-0.64	0.00	0.00	-6.90	-3.94	-7.88	-18.75
k3a0.1r0.5	36.74	-1.66	-0.35	-2.94	-8.82	-9.09	-7.14	-9.04	-10.77
k3a0.1r0.7	38.45	-0.40	-0.39	-2.70	0.00	0.00	-2.09	-2.00	-5.00
k3a0.1r1.0	35.25	-0.96	-0.96	-3.03	-3.12	-6.45	-2.63	-3.45	-5.54
k3a0.3r0.1	90.08	0.03	-0.89	0.00	0.00	0.00	-0.05	-0.23	0.23
k3a0.3r0.3	91.00	-0.28	-0.25	0.00	0.00	-1.14	0.25	-0.27	-0.68
k3a0.3r0.5	84.08	-0.17	-0.30	0.00	0.00	0.00	0.25	0.49	0.00
k3a0.3r0.7	89.08	-0.21	-0.19	0.00	1.18	0.00	-0.09	-0.19	-0.59
k3a0.3r1.0	86.20	-1.57	-1.26	-1.20	0.00	0.00	-0.73	-0.24	-0.61
k3a0.5r0.1	127.28	-0.03	-0.02	0.00	0.00	0.00	-0.16	-0.32	-0.40
k3a0.5r0.3	128.32	-0.17	-0.23	-0.79	0.00	0.00	-0.24	-0.32	-0.80
k3a0.5r0.5	124.87	-0.06	-0.09	-0.81	0.00	0.00	-0.48	-0.33	-0.08
k3a0.5r0.7	127.26	-0.05	-0.04	-0.79	0.00	0.81	-0.08	0.48	1.22
k3a0.5r1.0	118.83	0.21	-0.02	0.00	-0.86	-0.87	-0.98	-1.28	-1.05
k3a0.7r0.1	167.47	-0.07	-0.06	-0.60	0.00	0.00	-0.30	0.00	0.00
k3a0.7r0.3	160.19	0.10	-0.14	0.63	0.00	-0.64	0.11	-0.18	-0.45
k3a0.7r0.5	155.97	-0.13	-0.11	0.00	0.66	0.00	0.13	0.21	0.07
k3a0.7r0.7	159.69	-0.01	-0.05	0.00	0.00	-0.64	-0.15	-0.31	-0.13
k3a0.7r1.0	157.01	-0.00	-0.21	0.65	0.66	0.66	0.47	0.53	0.73
k3a1.0r0.1	193.66	-0.19	-0.11	0.00	0.00	0.52	0.13	0.25	0.37
k3a1.0r0.3	167.84	-0.05	-0.04	0.00	0.00	0.00	0.00	0.00	0.00
k3a1.0r0.5	201.22	-0.06	-0.08	0.00	0.00	0.51	0.05	0.10	0.25
k3a1.0r0.7	191.99	-0.01	-0.09	0.53	0.00	0.53	0.37	0.45	0.59
k3a1.0r1.0	182.87	-0.37	-0.06	0.00	0.00	-0.56	-0.04	-0.09	-0.11
k5a0.1r0.1	53.88	-4.00	-2.00	-9.80	-11.76	-12.24	-11.53	-12.50	-14.43
k5a0.1r0.3	57.09	-2.21	-4.65	0.00	0.00	0.00	-1.23	-2.97	-4.74
k5a0.1r0.5	67.83	-1.02	-2.51	-3.12	-3.17	-1.61	-3.33	-3.51	-4.03
k5a0.1r0.7	59.71	-2.45	-1.32	-5.36	-3.64	-7.41	-5.04	-5.63	-6.95
k5a0.1r1.0	56.79	-2.87	-1.13	-5.66	-3.85	-4.00	-4.66	-5.12	-5.05
k5a0.3r0.1	142.93	-0.11	-0.15	0.00	0.00	-0.72	-0.72	-1.69	-3.51
k5a0.3r0.3	127.63	-0.42	-0.43	-0.81	-0.81	-0.82	-0.86	-1.41	-2.73

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Instance	PFSPDPST	PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (0.5)	Sim BR-FF-VND (0.5)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k5a0.3r0.5	125.18	-0.14	-0.26	0.00	-0.82	-1.65	-0.61	-0.73	-0.83
k5a0.3r0.7	121.75	-0.46	-0.53	-1.67	-0.84	-0.85	-0.98	-0.95	-0.94
k5a0.3r1.0	130.24	-0.34	-0.36	-1.57	-1.60	-0.81	-1.68	-1.77	-1.22
k5a0.5r0.1	188.68	0.00	-0.04	0.54	1.09	0.55	0.88	0.90	0.77
k5a0.5r0.3	185.16	0.03	-0.08	-0.55	0.00	-0.56	-0.55	-0.62	-0.89
k5a0.5r0.5	193.29	0.16	0.00	-1.05	-1.06	-1.06	-1.11	-0.96	-0.80
k5a0.5r0.7	180.60	-0.15	-0.26	-0.56	0.00	0.00	-0.33	-0.05	-0.11
k5a0.5r1.0	178.88	-0.11	-0.09	0.00	0.00	0.58	0.11	0.23	0.29
k5a0.7r0.1	218.79	0.09	-0.03	0.00	0.00	-0.46	-0.29	-0.35	-0.74
k5a0.7r0.3	227.66	0.02	-0.09	0.00	-0.45	-0.45	-0.40	-0.43	-0.40
k5a0.7r0.5	220.26	-0.06	-0.17	0.00	0.00	-0.46	0.01	-0.17	-0.37
k5a0.7r0.7	232.06	-0.22	-0.27	0.00	0.00	0.89	0.35	0.53	0.89
k5a0.7r1.0	227.63	-0.31	-0.21	0.00	0.00	0.46	0.14	0.18	0.69
k5a1.0r0.1	273.39	-0.01	0.02	0.00	0.00	-0.74	-0.11	-0.22	-0.55
k5a1.0r0.3	283.57	-0.18	-0.03	-0.36	0.00	-0.36	-0.14	0.00	0.00
k5a1.0r0.5	282.70	-0.04	0.11	0.00	0.00	0.36	0.04	0.07	0.18
k5a1.0r0.7	292.28	-0.09	-0.16	-0.34	0.00	-0.35	-0.17	-0.07	0.00
k5a1.0r1.0	283.89	-0.20	-0.39	0.00	-0.71	-1.07	-0.72	-1.02	-1.29
k7a0.1r0.1	83.36	-1.74	-3.65	-4.94	-7.41	-6.25	-5.93	-6.69	-6.41
k7a0.1r0.3	90.12	-1.15	-0.77	-6.90	-5.88	-3.70	-6.90	-7.36	-10.60
k7a0.1r0.5	80.53	-1.20	-0.50	-2.63	-1.33	-2.70	-2.13	-2.15	-2.04
k7a0.1r0.7	74.69	-1.16	-0.50	-1.47	-1.49	-1.52	-1.35	-1.81	-2.27
k7a0.1r1.0	72.02	-3.40	-2.59	-4.48	-7.58	-4.76	-6.18	-7.19	-7.36
k7a0.3r0.1	167.40	-0.18	0.49	0.62	0.62	0.63	0.87	0.88	0.63
k7a0.3r0.3	185.04	-0.51	-0.43	-1.11	-1.12	-1.13	-0.94	-0.88	-0.68
k7a0.3r0.5	163.83	0.09	-0.22	-0.63	-0.64	-1.28	-0.70	-0.90	-0.96
k7a0.3r0.7	169.28	-0.23	-0.22	-1.80	-0.61	-1.24	-1.83	-1.71	-3.05
k7a0.3r1.0	152.28	-0.14	-0.22	-0.68	0.69	1.42	0.42	1.13	1.42
k7a0.5r0.1	245.60	-0.14	-0.09	0.00	0.00	0.00	-0.18	-0.49	-1.23
k7a0.5r0.3	254.34	-0.10	-0.11	0.00	-0.40	0.00	-0.03	-0.10	-0.08
k7a0.5r0.5	231.05	0.10	0.02	-0.88	-1.76	-0.89	-1.28	-1.24	-0.67
k7a0.5r0.7	242.86	-0.33	-0.15	-0.42	-0.42	-0.42	-0.52	-0.73	-0.85
k7a0.5r1.0	254.28	-0.13	-0.18	0.40	-0.80	-0.41	-0.40	-0.73	-0.41
k7a0.7r0.1	280.58	-0.20	-0.13	-1.08	-0.73	-0.73	-0.72	-0.48	-0.29
k7a0.7r0.3	303.89	0.15	0.04	0.33	0.67	0.34	0.44	0.34	0.10
k7a0.7r0.5	307.47	0.00	-0.09	-0.33	-0.33	0.33	-0.10	0.00	0.33
k7a0.7r0.7	300.12	-0.10	0.01	0.00	0.00	-0.34	-0.11	-0.18	-0.44
k7a0.7r1.0	296.46	-0.07	-0.12	0.00	0.00	-0.69	-0.02	-0.08	-0.28
k7a1.0r0.1	394.25	-0.09	-0.05	-0.26	-0.26	-1.03	-0.44	-0.56	-0.77
k7a1.0r0.3	350.60	-0.14	-0.13	-0.29	-0.29	-0.29	-0.35	-0.29	-0.29
k7a1.0r0.5	342.73	-0.12	-0.17	-0.29	0.00	-0.29	-0.24	-0.25	-0.41

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Instance	PFSPDPST		PFSPSTRD		Dev(%)				
	Sim BR-FF-VND (0.5)		Sim BR-FF-VND (0.5)		VaR α			CVaR α	
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k7a1.0r0.7	353.14	-0.08	-0.14	-0.28	-0.29	-0.57	-0.37	-0.46	-0.57
k7a1.0r1.0	330.17	-0.04	-0.05	0.00	0.00	0.00	-0.10	-0.09	-0.21
k10a0.1r0.1	107.65	-1.26	-3.25	0.00	2.02	0.00	0.40	0.20	-2.55
k10a0.1r0.3	106.82	2.04	0.01	0.00	-1.00	-3.03	-1.80	-2.63	-4.62
k10a0.1r0.5	118.53	-0.43	-1.29	0.00	0.92	1.87	0.20	0.89	1.80
k10a0.1r0.7	93.62	-0.41	-0.24	-1.16	-1.18	-2.41	-2.22	-2.74	-4.13
k10a0.1r1.0	97.41	-2.64	-1.36	-3.23	-5.38	-6.59	-4.45	-5.47	-6.11
k10a0.3r0.1	252.95	-0.65	-0.50	-2.02	-2.85	-2.47	-2.43	-2.52	-2.90
k10a0.3r0.3	234.19	-0.95	-0.49	-1.74	-1.32	-1.77	-1.59	-1.52	-1.87
k10a0.3r0.5	221.67	-0.35	-0.14	-0.94	-0.96	-1.44	-1.09	-1.42	-2.16
k10a0.3r0.7	217.69	-0.20	-0.24	-0.95	-0.96	-0.97	-1.15	-1.26	-1.46
k10a0.3r1.0	232.85	0.46	-0.31	0.00	0.00	0.00	-0.08	-0.30	-0.58
k10a0.5r0.1	363.25	-0.08	-0.06	0.00	-0.56	-0.56	-0.50	-0.62	-0.56
k10a0.5r0.3	333.10	-0.22	-0.24	-0.61	-0.92	-1.53	-1.23	-1.54	-2.03
k10a0.5r0.5	321.63	-0.34	-0.29	-0.95	-0.32	0.00	-0.57	-0.36	-0.23
k10a0.5r0.7	317.35	-0.41	-0.22	-0.64	-0.97	-0.33	-0.71	-0.72	-0.43
k10a0.5r1.0	314.88	-0.15	-0.20	0.00	0.00	-0.66	-0.10	-0.46	-0.82
k10a0.7r0.1	432.05	-0.17	-0.10	-0.47	-0.24	-0.24	-0.52	-0.61	-0.83
k10a0.7r0.3	439.89	0.17	-0.06	0.00	0.23	-0.23	-0.01	-0.06	-0.14
k10a0.7r0.5	422.81	-0.19	-0.04	-0.24	-0.24	-0.48	-0.41	-0.43	-0.60
k10a0.7r0.7	391.15	-0.18	-0.17	0.00	-0.26	-0.26	-0.28	-0.34	-0.50
k10a0.7r1.0	414.13	-0.35	-0.03	-0.74	-0.49	-0.74	-0.77	-0.87	-1.06
k10a1.0r0.1	570.33	0.02	0.04	-0.18	0.00	-0.36	-0.17	-0.29	-0.61
k10a1.0r0.3	515.00	-0.05	-0.03	-0.39	-0.20	0.20	-0.20	-0.08	0.10
k10a1.0r0.5	475.59	-0.06	-0.15	-0.42	-0.21	-0.21	-0.32	-0.30	-0.21
k10a1.0r0.7	528.89	-0.09	-0.14	0.00	0.58	0.78	0.48	0.74	0.78
k10a1.0r1.0	470.34	-0.17	-0.13	-0.43	-0.43	-0.86	-0.56	-0.69	-0.77
Average	166.15	-0.33	-0.36						

Table 1.16: Relative deviations for the Simheuristic best solutions (DevBest %). average of best solutions (AvgDev %). Value at Risk ($VaR\alpha$) and Conditional-Value-at-Risk (CVaR α) with three levels of confidence (95%. 97.5% and 99%) in a PFSPDPST to a Simheuristic Sim BR-FF-VND in a PFSPDPST with 1 minute stop time criterion and level of uncertainty of 0.5.

Instance	PFSPDPST	PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (1.0)	Sim BR-FF-VND (1.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k10a0.1r0.1	105.91	-1.28	-2.85	0.00	1.04	0.00	-0.08	-0.51	-1.39
k10a0.1r0.3	105.14	1.11	-0.46	-1.03	-3.12	-4.30	-3.78	-5.54	-9.84
k10a0.1r0.5	116.73	-0.57	-1.75	-0.92	-0.93	0.00	-1.13	-0.92	-1.18
k10a0.1r0.7	92.34	-1.20	-0.98	-5.75	-5.88	-7.14	-8.45	-10.17	-15.83
k10a0.1r1.0	96.36	-3.36	-2.13	-5.49	-4.55	-7.95	-5.74	-6.38	-7.43
k10a0.3r0.1	250.44	-0.92	-0.74	-1.66	-1.67	-1.28	-2.26	-2.80	-5.02
k10a0.3r0.3	232.33	-1.29	-0.66	-1.78	-1.36	-0.92	-1.49	-1.28	-1.38
k10a0.3r0.5	218.69	-0.53	-0.47	-0.48	-0.49	-0.49	-0.73	-0.79	-1.98
k10a0.3r0.7	215.24	-0.32	-0.43	-1.46	-1.97	-2.99	-2.16	-2.78	-3.23
k10a0.3r1.0	229.94	0.23	-0.44	0.46	0.93	0.93	0.34	0.56	0.56
k10a0.5r0.1	361.20	-0.18	-0.14	-0.56	-0.57	-0.57	-1.02	-1.41	-2.51
k10a0.5r0.3	331.05	-0.31	-0.32	-0.93	-1.24	-1.87	-1.27	-1.62	-1.88
k10a0.5r0.5	319.49	-0.57	-0.41	-1.29	0.33	0.33	-0.40	-0.05	-0.26
k10a0.5r0.7	315.18	-0.68	-0.29	-0.33	0.00	-0.99	-0.51	-0.75	-1.39
k10a0.5r1.0	312.20	-0.28	-0.34	0.33	0.33	-0.67	0.03	-0.27	-0.67
k10a0.7r0.1	430.17	-0.24	-0.15	-0.47	-0.24	-1.91	-0.79	-1.29	-2.87
k10a0.7r0.3	437.48	0.06	-0.11	0.00	-0.23	0.00	-0.02	-0.09	0.00
k10a0.7r0.5	420.44	-0.34	-0.14	-0.49	-1.22	-0.74	-0.90	-1.03	-0.98
k10a0.7r0.7	388.75	-0.17	-0.20	-0.26	-1.06	-1.06	-0.64	-0.84	-0.80
k10a0.7r1.0	411.13	-0.39	-0.15	-0.25	0.00	-0.76	-0.26	-0.29	-0.33
k10a1.0r0.1	568.08	0.06	0.05	0.00	-0.18	-0.36	-0.17	-0.17	-0.49
k10a1.0r0.3	513.80	-0.06	-0.03	0.00	0.00	0.00	0.00	0.00	0.10
k10a1.0r0.5	473.81	-0.09	-0.19	-0.21	0.00	0.00	0.01	0.16	0.30
k10a1.0r0.7	526.44	-0.12	-0.19	0.39	0.39	1.18	0.58	0.78	0.98
k10a1.0r1.0	469.15	-0.30	-0.22	-0.43	-0.43	-0.86	-0.58	-0.64	-0.72
k1a0.1r0.1	20.59	-0.36	-0.89	0.00	0.00	5.56	1.06	2.15	5.56
k1a0.1r0.3	21.67	-0.53	-0.66	0.00	-4.76	0.00	-1.46	-1.98	-2.50
k1a0.1r0.5	20.45	-0.78	-0.78	0.00	0.00	-5.26	-0.53	-1.06	-2.70
k1a0.1r0.7	16.50	-0.58	-0.89	0.00	0.00	0.00	-1.07	-2.13	-5.33
k1a0.1r1.0	19.57	-0.26	-0.62	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.1	45.41	-0.48	-0.39	2.33	2.33	4.76	2.71	3.10	4.29
k1a0.3r0.3	44.77	-0.28	-0.16	0.00	0.00	2.38	0.14	0.47	1.19
k1a0.3r0.5	45.55	-0.25	-0.37	0.00	0.00	2.33	0.00	0.00	0.00
k1a0.3r0.7	46.54	-0.29	-0.37	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r1.0	43.39	-0.29	-0.46	0.00	0.00	0.00	-1.22	-2.44	-6.10
k1a0.5r0.1	64.57	-0.10	-0.06	0.00	0.00	1.61	0.51	1.03	0.65
k1a0.5r0.3	62.43	0.15	-0.15	-1.61	0.00	0.00	-0.16	0.33	0.00
k1a0.5r0.5	66.91	-0.05	-0.03	0.00	1.54	0.00	0.31	0.37	0.15
k1a0.5r0.7	64.73	-0.12	-0.23	0.00	0.00	0.00	-0.03	-0.06	-0.16
k1a0.5r1.0	59.08	-0.81	-0.29	0.00	1.79	0.00	0.18	0.29	-0.36
k1a0.7r0.1	80.33	-0.13	-0.02	-1.27	-1.27	0.00	-1.07	-0.87	-0.26

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Instance	PFSPDPST	PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (1.0)	Sim BR-FF-VND (1.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k1a0.7r0.3	80.58	-0.18	-0.15	-1.27	0.00	0.00	-0.15	-0.05	-0.13
k1a0.7r0.5	79.50	-0.13	-0.10	-1.28	0.00	0.00	-0.36	-0.21	-0.52
k1a0.7r0.7	78.43	-0.01	-0.07	0.00	0.00	0.00	0.05	0.11	0.00
k1a0.7r1.0	78.28	0.17	-0.08	0.00	0.00	-1.32	-0.65	-1.31	-1.97
k1a1.0r0.1	98.83	-0.07	-0.08	0.00	0.00	0.00	-0.10	-0.21	0.00
k1a1.0r0.3	98.51	0.00	-0.04	0.00	0.00	-1.03	-0.10	-0.21	-0.52
k1a1.0r0.5	98.95	-0.07	0.01	0.00	0.00	0.00	0.10	0.21	0.00
k1a1.0r0.7	97.68	-0.10	-0.03	0.00	0.00	0.00	-0.06	-0.13	-0.31
k1a1.0r1.0	96.62	-0.17	-0.36	-1.05	-1.05	-1.06	-0.89	-0.72	-1.06
k2a0.1r0.1	28.27	0.38	0.58	0.00	0.00	0.00	0.86	-0.95	-4.00
k2a0.1r0.3	29.03	-0.26	-0.26	-3.70	-3.70	4.00	-2.26	-0.76	4.00
k2a0.1r0.5	27.20	-1.43	-2.26	-4.00	-8.00	-8.00	-6.43	-8.87	-10.20
k2a0.1r0.7	28.93	-0.62	-1.20	0.00	-3.85	-12.00	-3.52	-7.14	-12.24
k2a0.1r1.0	25.72	-4.72	-4.35	-4.35	-8.70	-8.70	-6.99	-8.77	-8.89
k2a0.3r0.1	70.56	-0.12	-0.08	0.00	0.00	0.00	0.30	0.60	0.00
k2a0.3r0.3	66.92	-0.31	-0.25	-1.54	0.00	0.00	-0.31	0.31	0.79
k2a0.3r0.5	61.14	-0.20	-0.10	1.72	1.72	0.00	1.38	1.04	0.87
k2a0.3r0.7	69.88	-0.13	-0.42	1.49	0.00	0.00	0.24	-0.24	-0.45
k2a0.3r1.0	62.66	-0.32	-0.97	1.67	1.69	0.00	1.35	1.02	0.00
k2a0.5r0.1	99.63	-0.26	-0.37	-1.02	-1.03	0.00	-0.87	-0.67	-0.63
k2a0.5r0.3	97.48	-0.41	-0.22	0.00	0.00	-1.06	0.00	-0.30	-0.75
k2a0.5r0.5	97.66	-0.41	-0.30	0.00	1.06	0.00	0.59	0.64	0.21
k2a0.5r0.7	92.03	0.03	-0.18	0.00	-1.11	-1.12	-0.67	-1.12	-1.69
k2a0.5r1.0	85.64	-0.24	0.08	-1.19	-1.20	-1.22	-1.57	-1.70	-1.84
k2a0.7r0.1	116.67	-0.13	-0.13	-0.87	0.00	0.88	0.09	0.25	0.53
k2a0.7r0.3	114.00	0.25	0.07	0.90	-0.90	0.00	0.00	-0.54	0.00
k2a0.7r0.5	113.08	-0.17	-0.15	0.00	0.92	1.85	0.97	1.40	1.67
k2a0.7r0.7	117.17	-0.33	-0.22	0.00	0.00	0.88	0.07	0.14	0.35
k2a0.7r1.0	109.33	-0.27	-0.25	0.00	0.00	0.00	-0.32	-0.12	-0.29
k2a1.0r0.1	150.59	0.04	-0.03	0.00	0.68	0.00	0.24	0.43	0.07
k2a1.0r0.3	149.66	-0.14	-0.16	0.00	0.68	0.68	0.27	0.54	0.34
k2a1.0r0.5	153.10	0.04	0.05	0.67	0.00	0.00	0.20	0.00	0.00
k2a1.0r0.7	149.69	-0.09	-0.05	0.00	-0.68	0.00	-0.27	-0.38	0.07
k2a1.0r1.0	140.32	-0.21	-0.20	0.00	-0.72	0.00	-0.58	-0.50	0.00
k3a0.1r0.1	38.41	-1.24	-1.62	-2.78	-5.56	-5.71	-3.92	-5.08	-5.71
k3a0.1r0.3	31.39	-0.38	-0.83	0.00	-3.45	-3.70	-6.34	-10.79	-25.93
k3a0.1r0.5	35.97	-1.51	-0.85	-6.06	-9.09	-12.50	-8.13	-10.31	-11.48
k3a0.1r0.7	38.03	-0.92	-0.79	-2.78	-2.94	-2.94	-3.47	-5.29	-8.82
k3a0.1r1.0	34.63	-1.40	-1.85	-3.23	0.00	0.00	-1.74	-1.77	-5.17
k3a0.3r0.1	89.41	0.02	-0.92	0.00	-1.16	-1.16	-0.81	-1.16	-1.16
k3a0.3r0.3	90.24	-0.38	-0.35	0.00	-1.15	0.00	-0.12	-0.23	0.00

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Instance	PFSPDPST	PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (1.0)	Sim BR-FF-VND (1.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k3a0.3r0.5	83.45	-0.17	-0.45	0.00	-1.23	-1.25	-0.50	-1.00	-1.25
k3a0.3r0.7	88.22	-0.36	-0.24	-1.18	0.00	-2.38	-0.95	-1.43	-2.38
k3a0.3r1.0	85.25	-1.47	-1.45	1.23	-1.23	-2.50	-0.99	-1.99	-3.14
k3a0.5r0.1	126.67	-0.05	-0.08	0.00	0.00	0.00	-0.18	-0.10	-0.33
k3a0.5r0.3	127.55	-0.16	-0.28	0.00	-0.80	0.00	0.23	0.45	1.22
k3a0.5r0.5	124.03	-0.06	-0.17	0.00	0.00	-0.83	-0.08	-0.43	-0.76
k3a0.5r0.7	126.49	0.03	-0.11	0.00	0.00	0.00	-0.08	-0.16	0.00
k3a0.5r1.0	117.75	0.05	-0.10	-0.88	-1.75	-1.77	-1.34	-1.28	-0.63
k3a0.7r0.1	166.91	-0.10	-0.11	0.00	0.00	-0.61	-0.23	-0.47	-0.86
k3a0.7r0.3	159.46	0.05	-0.17	0.00	0.00	0.00	0.05	-0.05	0.26
k3a0.7r0.5	155.10	-0.19	-0.17	0.00	-0.66	0.00	-0.20	-0.26	-0.33
k3a0.7r0.7	158.93	-0.05	-0.09	0.00	0.00	0.00	-0.54	-0.60	-0.65
k3a0.7r1.0	156.11	-0.00	-0.03	0.66	0.67	0.67	0.55	0.64	0.60
k3a1.0r0.1	193.02	-0.10	-0.12	0.00	0.53	0.00	0.15	0.23	0.11
k3a1.0r0.3	167.68	-0.11	-0.06	0.00	0.00	-0.60	-0.12	-0.24	-0.60
k3a1.0r0.5	200.59	-0.11	-0.10	0.00	0.51	0.51	0.10	0.20	0.26
k3a1.0r0.7	191.25	-0.08	-0.17	0.00	0.00	-0.53	-0.10	-0.19	-0.43
k3a1.0r1.0	181.88	-0.28	-0.08	0.00	0.00	0.00	0.00	-0.23	-0.17
k5a0.1r0.1	53.27	-4.07	-2.41	-12.00	-12.50	-13.04	-13.10	-14.04	-16.30
k5a0.1r0.3	55.88	-2.90	-4.67	-3.92	-6.00	-10.20	-7.95	-10.65	-14.23
k5a0.1r0.5	66.57	-1.57	-2.99	-4.84	-5.00	-8.33	-6.13	-6.73	-9.40
k5a0.1r0.7	58.69	-4.09	-2.16	-7.41	-5.77	-6.00	-6.77	-6.77	-8.16
k5a0.1r1.0	55.78	-3.90	-1.67	-5.88	-4.08	-6.12	-6.21	-5.71	-7.14
k5a0.3r0.1	141.90	-0.28	-0.31	-0.73	-1.46	-2.96	-2.59	-4.29	-7.56
k5a0.3r0.3	126.33	-0.59	-0.66	-0.83	-0.83	-0.84	-0.92	-1.17	-1.68
k5a0.3r0.5	124.42	-0.37	-0.49	-0.83	-0.84	-0.85	-0.83	-0.89	-1.38
k5a0.3r0.7	121.03	-0.62	-0.44	0.00	0.00	-0.87	-0.43	-0.70	-0.88
k5a0.3r1.0	128.81	-0.60	-0.58	-0.81	-0.82	0.00	-0.49	-0.50	-0.83
k5a0.5r0.1	187.75	-0.04	-0.10	0.00	0.00	0.56	-0.17	-0.46	-0.78
k5a0.5r0.3	184.14	-0.05	-0.13	-0.56	-0.56	0.00	-0.77	-0.88	-1.02
k5a0.5r0.5	192.19	0.09	-0.09	-0.53	-0.54	-1.08	-0.98	-1.25	-1.95
k5a0.5r0.7	178.98	-0.22	-0.29	-0.57	-0.57	-0.58	-0.40	-0.58	-0.87
k5a0.5r1.0	177.62	-0.24	-0.20	0.58	0.00	-1.17	0.00	-0.47	-0.88
k5a0.7r0.1	218.05	-0.02	-0.10	-0.47	-0.47	-0.47	-0.50	-0.56	-0.57
k5a0.7r0.3	226.39	-0.02	-0.15	-0.45	-0.45	0.00	-0.27	-0.36	0.00
k5a0.7r0.5	219.12	-0.12	-0.20	0.00	-0.47	-0.94	-0.64	-0.86	-0.99
k5a0.7r0.7	230.60	-0.10	-0.27	0.44	0.00	0.00	0.13	0.00	0.22
k5a0.7r1.0	225.75	-0.36	-0.36	0.46	0.00	-1.39	-0.23	-0.46	-1.39
k5a1.0r0.1	273.05	-0.03	-0.01	0.00	0.00	-0.37	-0.18	-0.22	-0.56
k5a1.0r0.3	282.52	-0.15	-0.06	0.00	0.00	0.36	0.06	0.26	0.62
k5a1.0r0.5	282.01	-0.03	0.10	0.00	0.00	-0.36	-0.09	-0.29	-0.61

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Instance	PFSPDPST		PFSPSTRD			Dev(%)				
	Sim BR-FF-VND (1.0)		Sim BR-FF-VND (1.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%	
k5a1.0r0.7	291.20	-0.13	-0.20	0.00	0.00	0.00	-0.14	-0.14	-0.18	
k5a1.0r1.0	282.58	-0.28	-0.46	-0.72	-0.72	-0.73	-0.92	-1.06	-1.20	
k7a0.1r0.1	82.86	-3.03	-4.26	-7.50	-8.86	-10.26	-8.64	-9.44	-10.46	
k7a0.1r0.3	88.93	-2.00	-2.14	-4.88	-5.06	-7.79	-7.92	-11.21	-19.35	
k7a0.1r0.5	79.34	-2.34	-1.28	-4.11	-4.17	-5.63	-4.91	-6.57	-9.93	
k7a0.1r0.7	72.97	-1.79	-1.22	-1.54	-3.08	-6.25	-5.71	-9.19	-15.56	
k7a0.1r1.0	70.76	-4.20	-3.37	-4.76	-4.84	-8.20	-7.04	-8.53	-11.31	
k7a0.3r0.1	165.73	-0.10	0.42	0.00	0.00	0.00	-0.32	-0.13	-0.32	
k7a0.3r0.3	183.12	-0.60	-0.56	0.00	0.00	0.58	0.10	0.25	0.64	
k7a0.3r0.5	162.07	0.05	-0.34	0.00	-1.31	1.35	-0.59	-0.27	0.68	
k7a0.3r0.7	167.81	-0.67	-0.54	-0.62	-1.90	-2.55	-1.65	-1.79	-1.29	
k7a0.3r1.0	150.64	-0.18	-0.26	0.70	1.43	2.19	1.36	1.74	1.83	
k7a0.5r0.1	243.79	-0.19	-0.19	0.00	0.43	-0.43	0.13	0.09	-0.21	
k7a0.5r0.3	252.93	-0.21	-0.22	-0.40	-0.41	-0.82	-0.41	-0.57	-0.62	
k7a0.5r0.5	229.76	-0.26	-0.15	-0.45	-0.45	-0.90	-0.83	-1.12	-1.27	
k7a0.5r0.7	241.08	-0.25	-0.22	-0.43	-0.86	0.44	-0.56	-0.61	-0.22	
k7a0.5r1.0	252.25	-0.29	-0.31	-0.82	-0.41	-1.23	-0.78	-0.90	-1.44	
k7a0.7r0.1	279.11	-0.18	-0.21	-0.73	-0.73	0.37	-0.44	-0.30	0.19	
k7a0.7r0.3	301.75	0.19	-0.01	0.00	-0.34	-0.68	-0.44	-0.75	-1.20	
k7a0.7r0.5	305.90	0.03	-0.15	0.33	0.67	1.71	0.62	0.86	0.93	
k7a0.7r0.7	298.63	-0.17	-0.03	-0.34	-1.02	-1.37	-1.02	-1.26	-1.48	
k7a0.7r1.0	294.38	-0.10	-0.20	0.70	0.70	0.71	0.70	0.78	0.71	
k7a1.0r0.1	393.07	-0.17	-0.08	-0.26	-0.26	-0.78	-0.31	-0.36	-0.65	
k7a1.0r0.3	350.06	-0.20	-0.17	-0.29	-0.58	0.00	-0.38	-0.23	0.00	
k7a1.0r0.5	341.80	-0.20	-0.23	-0.30	-0.59	-0.30	-0.36	-0.40	-0.42	
k7a1.0r0.7	352.25	-0.14	-0.20	-0.29	-0.57	-0.58	-0.66	-0.63	-0.58	
k7a1.0r1.0	329.25	-0.10	-0.13	0.00	0.00	-0.31	-0.09	-0.15	-0.28	
Average	165.14	-0.50	-0.52							

Table 1.17: Relative deviations for the Simheuristic best solutions (DevBest %). average of best solutions (AvgDev %). Value at Risk ($VaR\alpha$) and Conditional-Value-at-Risk ($CVaR\alpha$) with three levels of confidence (95%. 97.5% and 99%) in a PFSPDPST to a Simheuristic Sim BR-FF-VND in a PFSPDST with 1 minute stop time criterion and level of uncertainty of 1.0.

Instance	PFSPDPST		PFSPSTRD		Dev(%)				
	Sim BR-FF-VND (2.0)		Sim BR-FF-VND (2.0)		VaR α			CVaR α	
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k1a0.1r0.1	20.37	-0.56	-1.11	-5.26	0.00	-11.11	-4.86	-4.44	-11.11
k1a0.1r0.3	21.43	-1.10	-1.19	0.00	-5.00	-5.00	-4.52	-5.05	-5.13
k1a0.1r0.5	20.06	-1.00	-0.90	-5.26	0.00	-5.56	-2.20	-1.12	-2.86
k1a0.1r0.7	16.23	-1.36	-1.48	-6.67	0.00	-7.14	-4.20	-2.90	-3.70
k1a0.1r1.0	19.23	-0.75	-1.05	0.00	-5.88	0.00	-2.40	-2.44	0.00
k1a0.3r0.1	45.03	-0.44	-0.39	-2.33	0.00	0.00	-0.95	-0.96	0.00
k1a0.3r0.3	44.38	-0.44	-0.36	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r0.5	45.20	-0.69	-0.50	0.00	-2.33	0.00	-1.17	-1.41	0.00
k1a0.3r0.7	46.14	-0.39	-0.43	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.3r1.0	42.64	-0.43	-0.89	0.00	-4.88	-7.69	-2.44	-4.47	-5.01
k1a0.5r0.1	64.22	-0.14	-0.11	0.00	-1.61	0.00	-0.26	-0.52	0.49
k1a0.5r0.3	62.12	0.08	-0.27	0.00	0.00	-1.67	-0.33	-0.67	-1.01
k1a0.5r0.5	66.64	-0.21	-0.11	0.00	0.00	0.00	-0.31	-0.62	0.00
k1a0.5r0.7	64.31	-0.30	-0.35	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.5r1.0	58.29	-0.77	-0.44	0.00	0.00	0.00	-0.36	-0.44	-0.56
k1a0.7r0.1	79.82	-0.30	-0.09	0.00	0.00	-1.30	-0.23	-0.47	-0.92
k1a0.7r0.3	80.14	-0.16	-0.17	0.00	0.00	0.00	0.00	0.00	0.00
k1a0.7r0.5	79.00	-0.19	-0.24	0.00	1.30	0.00	1.10	1.00	0.26
k1a0.7r0.7	77.94	-0.03	-0.04	0.00	0.00	-1.32	-0.13	-0.26	0.00
k1a0.7r1.0	77.85	-0.03	-0.06	-2.63	-1.33	-1.35	-1.60	-1.34	-1.49
k1a1.0r0.1	98.49	-0.09	-0.13	0.00	0.00	0.00	0.00	0.00	0.00
k1a1.0r0.3	98.13	-0.08	-0.11	0.00	0.00	1.05	0.21	0.42	1.05
k1a1.0r0.5	98.67	-0.12	-0.03	0.00	0.00	1.04	0.12	0.25	0.10
k1a1.0r0.7	97.45	-0.21	-0.08	0.00	-1.04	-1.04	-0.79	-0.84	-0.52
k1a1.0r1.0	96.03	-0.23	-0.44	-1.06	0.00	0.00	-0.69	-0.30	0.00
k2a0.1r0.1	27.88	0.36	0.38	0.00	0.00	4.35	0.82	1.68	0.00
k2a0.1r0.3	28.66	-1.14	-1.17	-3.70	-3.85	0.00	-2.03	-2.08	-1.25
k2a0.1r0.5	26.69	-3.61	-2.30	-12.50	-13.04	-4.76	-11.33	-11.30	-12.68
k2a0.1r0.7	28.22	-2.57	-2.34	0.00	4.55	4.76	1.78	2.78	2.38
k2a0.1r1.0	25.27	-7.34	-5.03	-13.04	-13.64	-14.29	-13.64	-14.15	-14.29
k2a0.3r0.1	70.01	-0.13	-0.13	-1.47	-1.49	0.00	-1.05	-0.60	-0.76
k2a0.3r0.3	66.36	-0.59	-0.44	-1.56	-1.56	-1.59	-1.82	-2.08	-1.92
k2a0.3r0.5	60.62	-0.39	-0.19	0.00	0.00	1.79	-0.17	-0.35	0.54
k2a0.3r0.7	69.27	-0.49	-0.69	0.00	0.00	0.00	-0.43	-0.74	-1.88
k2a0.3r1.0	61.99	-0.38	-1.33	-1.69	0.00	0.00	-0.17	0.35	0.90
k2a0.5r0.1	99.14	-0.38	-0.52	-1.04	0.00	-1.05	-0.82	-0.93	-1.27
k2a0.5r0.3	96.78	-0.57	-0.37	1.08	-1.08	0.00	0.11	-0.22	-0.44
k2a0.5r0.5	96.81	-0.12	-0.26	1.08	1.09	1.10	0.96	0.92	1.33
k2a0.5r0.7	91.28	-0.29	-0.35	-1.14	0.00	-1.16	-0.69	-0.46	-1.16
k2a0.5r1.0	84.83	-0.49	-0.29	-2.44	-1.25	-2.50	-1.99	-1.70	-2.26
k2a0.7r0.1	116.00	-0.17	-0.20	0.00	0.89	0.90	0.18	0.36	0.45

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Instance	PFSPDPST		PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (2.0)		Sim BR-FF-VND (2.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%	
k2a0.7r0.3	113.27	0.23	0.01	0.00	0.00	0.00	-0.09	-0.18	0.00	
k2a0.7r0.5	112.40	-0.32	-0.28	-0.91	0.00	-0.93	-0.71	-0.70	-0.93	
k2a0.7r0.7	116.42	-0.32	-0.26	0.00	0.00	0.00	-0.11	-0.21	-0.18	
k2a0.7r1.0	108.05	-0.31	-0.32	-0.96	0.00	-0.98	-0.49	-0.59	-0.98	
k2a1.0r0.1	150.38	0.03	-0.06	0.68	0.68	2.07	0.75	1.10	1.38	
k2a1.0r0.3	149.39	-0.21	-0.16	0.68	0.00	0.68	0.15	0.25	0.27	
k2a1.0r0.5	152.54	-0.06	-0.06	0.00	0.00	0.68	-0.13	0.00	-0.34	
k2a1.0r0.7	149.03	-0.10	-0.09	0.00	-0.68	-0.68	-0.42	-0.41	-0.34	
k2a1.0r1.0	139.50	-0.31	-0.25	0.00	0.74	0.75	0.37	0.59	0.75	
k3a0.1r0.1	37.83	-1.56	-1.94	-2.86	-2.94	-6.25	-5.59	-6.67	-6.35	
k3a0.1r0.3	30.66	-0.55	-0.79	0.00	3.85	-12.00	-5.60	-11.90	-37.50	
k3a0.1r0.5	35.20	-2.17	-1.63	10.00	6.90	-10.71	1.37	-2.82	-12.50	
k3a0.1r0.7	37.27	-1.68	-1.70	-3.03	-3.12	-3.23	-4.69	-7.01	-12.90	
k3a0.1r1.0	33.74	-2.56	-2.49	0.00	-3.45	-10.71	-3.87	-6.47	-9.93	
k3a0.3r0.1	88.52	-0.09	-0.93	0.00	0.00	0.00	0.07	-0.05	0.12	
k3a0.3r0.3	89.47	-0.59	-0.50	0.00	0.00	0.00	-0.12	0.00	0.00	
k3a0.3r0.5	82.53	-0.35	-0.73	1.28	1.30	1.32	0.65	0.78	1.32	
k3a0.3r0.7	87.22	-0.60	-0.47	-2.38	-2.41	-1.23	-2.18	-1.72	-1.86	
k3a0.3r1.0	84.14	-1.56	-1.66	0.00	0.00	1.32	-0.46	-0.16	-0.93	
k3a0.5r0.1	125.80	-0.14	-0.16	0.00	0.00	-0.83	-0.25	-0.50	-0.83	
k3a0.5r0.3	126.50	-0.19	-0.39	-0.81	-0.81	-0.82	-0.73	-0.98	-0.82	
k3a0.5r0.5	122.92	-0.09	-0.29	0.00	0.00	-1.69	-0.69	-1.16	-1.79	
k3a0.5r0.7	125.48	-0.16	-0.22	-1.64	-0.83	-0.83	-1.07	-0.50	0.00	
k3a0.5r1.0	116.19	-0.35	-0.26	-1.80	-1.82	-2.75	-1.71	-1.91	-1.67	
k3a0.7r0.1	165.94	-0.07	-0.19	0.00	0.00	0.00	-0.16	-0.08	0.06	
k3a0.7r0.3	158.46	-0.27	-0.30	0.00	0.00	0.65	-0.06	0.26	0.66	
k3a0.7r0.5	154.05	-0.19	-0.22	0.00	-0.67	0.00	-0.11	-0.14	0.00	
k3a0.7r0.7	157.88	-0.05	-0.18	-1.29	-1.30	-1.96	-1.33	-1.26	-1.19	
k3a0.7r1.0	154.93	-0.02	0.01	0.67	1.36	0.68	0.92	1.01	1.10	
k3a1.0r0.1	192.28	-0.18	-0.15	-0.53	-0.53	0.00	-0.42	-0.68	-0.90	
k3a1.0r0.3	167.53	-0.18	-0.08	-0.60	-0.60	0.00	-0.36	-0.12	0.00	
k3a1.0r0.5	199.60	-0.04	-0.11	0.00	0.00	-1.54	-0.22	-0.62	-1.08	
k3a1.0r0.7	190.46	-0.24	-0.26	-0.53	-1.06	-1.06	-0.75	-0.96	-0.80	
k3a1.0r1.0	180.55	-0.29	-0.12	-0.57	-0.57	0.00	-0.53	-0.35	0.47	
k5a0.1r0.1	52.19	-4.25	-2.95	-10.64	-9.09	-14.29	-11.71	-12.68	-21.43	
k5a0.1r0.3	54.48	-3.99	-5.27	-8.33	-8.51	-13.04	-11.59	-14.83	-22.39	
k5a0.1r0.5	65.02	-2.96	-4.32	-10.34	-12.50	-11.11	-10.95	-12.41	-13.89	
k5a0.1r0.7	57.31	-5.22	-3.85	-6.00	-10.20	-8.70	-9.28	-10.59	-8.89	
k5a0.1r1.0	54.51	-5.06	-2.35	-8.16	-10.64	-10.87	-8.76	-9.61	-8.89	
k5a0.3r0.1	140.57	-0.65	-0.47	-1.48	-2.26	-3.05	-3.98	-6.18	-11.88	
k5a0.3r0.3	124.64	-0.70	-0.88	-2.52	-1.71	-2.59	-1.97	-1.73	-1.75	

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Instance	PFSPDPST	PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (2.0)	Sim BR-FF-VND (2.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k5a0.3r0.5	122.97	-0.61	-0.64	-0.86	-0.88	-0.92	-1.37	-1.34	-1.85
k5a0.3r0.7	119.58	-0.75	-0.70	0.00	-2.68	-3.67	-1.53	-2.75	-3.74
k5a0.3r1.0	127.08	-0.67	-0.86	-0.83	-2.50	-4.27	-3.28	-4.64	-6.55
k5a0.5r0.1	186.50	-0.21	-0.18	-0.55	-0.56	0.00	-1.19	-1.74	-3.18
k5a0.5r0.3	182.72	-0.20	-0.16	0.00	0.00	-1.15	-0.71	-1.17	-1.80
k5a0.5r0.5	190.66	-0.06	-0.22	-1.09	-1.09	-2.20	-1.74	-2.44	-3.61
k5a0.5r0.7	177.24	-0.21	-0.40	0.00	-1.17	-2.94	-0.76	-0.95	-0.90
k5a0.5r1.0	176.01	-0.69	-0.55	-0.59	-0.60	-1.82	-1.02	-0.97	-1.54
k5a0.7r0.1	216.94	-0.22	-0.19	0.00	0.48	0.00	0.05	0.38	0.48
k5a0.7r0.3	225.47	-0.38	-0.25	-0.45	-1.37	-1.38	-0.96	-1.38	-1.38
k5a0.7r0.5	217.57	-0.22	-0.28	-0.94	-0.48	-1.44	-0.95	-0.77	-1.44
k5a0.7r0.7	229.07	-0.21	-0.33	-2.68	-2.70	-2.73	-2.61	-2.45	-2.06
k5a0.7r1.0	223.53	-0.62	-0.50	-1.39	-1.41	-0.48	-1.08	-0.95	-0.48
k5a1.0r0.1	272.33	-0.01	-0.05	0.00	-0.37	-0.75	-0.37	-0.60	-0.93
k5a1.0r0.3	281.08	-0.21	-0.09	-0.36	-0.36	0.00	-0.19	-0.04	0.33
k5a1.0r0.5	281.09	-0.09	0.01	-0.36	0.00	0.00	-0.13	-0.23	-0.33
k5a1.0r0.7	289.22	-0.18	-0.17	-0.35	-0.36	-0.36	-0.36	-0.63	-1.08
k5a1.0r1.0	280.77	-0.38	-0.47	0.00	0.00	-0.37	-0.21	-0.34	-0.74
k7a0.1r0.1	82.09	-4.82	-5.24	-10.53	-9.59	-9.72	-9.00	-8.38	-7.80
k7a0.1r0.3	86.96	-2.91	-2.47	-7.69	-8.00	-12.50	-12.44	-17.55	-32.33
k7a0.1r0.5	77.61	-3.18	-2.30	-2.86	-2.90	-4.41	-2.92	-2.65	-3.73
k7a0.1r0.7	71.11	-2.64	-2.18	-1.64	-3.33	-6.78	-6.62	-10.82	-21.21
k7a0.1r1.0	69.33	-4.51	-3.80	-4.92	-6.56	-5.00	-5.60	-6.29	-6.67
k7a0.3r0.1	163.47	-0.18	0.23	0.65	1.32	2.68	1.45	1.86	2.02
k7a0.3r0.3	180.53	-0.76	-0.69	-0.58	0.59	0.60	0.48	1.03	1.40
k7a0.3r0.5	159.50	-0.10	-0.57	0.68	-0.68	-2.04	-0.61	-1.09	-1.72
k7a0.3r0.7	165.33	-1.12	-0.87	-2.58	-1.32	-1.34	-1.91	-1.46	-0.68
k7a0.3r1.0	148.61	-0.28	-0.40	0.72	1.46	3.82	1.54	1.94	3.05
k7a0.5r0.1	241.57	-0.35	-0.36	-0.86	-1.29	-1.73	-1.51	-1.90	-2.39
k7a0.5r0.3	250.44	-0.33	-0.37	-1.24	0.00	-0.85	-0.55	-0.42	-0.64
k7a0.5r0.5	227.43	-0.30	-0.18	-0.45	-0.92	-1.39	-1.21	-1.24	-0.71
k7a0.5r0.7	238.69	-0.49	-0.37	-1.30	-0.44	-1.35	-1.15	-1.08	-0.69
k7a0.5r1.0	249.84	-0.67	-0.49	-0.42	-0.84	-2.54	-1.14	-1.69	-2.55
k7a0.7r0.1	277.51	-0.12	-0.15	-0.37	0.00	1.15	0.07	0.45	1.15
k7a0.7r0.3	299.41	0.03	-0.16	-0.34	-0.35	-1.74	-0.90	-1.39	-2.64
k7a0.7r0.5	303.25	0.05	-0.34	0.00	-0.69	-0.35	-0.32	-0.45	-0.56
k7a0.7r0.7	296.15	-0.31	-0.29	-0.70	-1.05	-1.77	-0.99	-1.20	-1.42
k7a0.7r1.0	292.70	-0.47	-0.39	0.00	-0.35	0.00	-0.39	-0.51	-0.22
k7a1.0r0.1	391.42	-0.26	-0.20	0.00	0.00	0.52	0.08	0.26	0.26
k7a1.0r0.3	349.19	-0.15	-0.20	0.00	-0.29	-0.29	-0.32	-0.45	-0.61
k7a1.0r0.5	340.37	-0.28	-0.33	-0.30	-0.30	-0.60	-0.48	-0.67	-0.93

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Instance	PFSPDPST	PFSPSTRD		Dev(%)					
	Sim BR-FF-VND (2.0)	Sim BR-FF-VND (2.0)		VaR α			CVaR α		
	BestSol	BestDev (%)	AvgDev (%)	95%	97.5%	99%	95%	97.5%	99%
k7a1.0r0.7	350.95	-0.27	-0.28	-0.29	-0.58	-0.29	-0.43	-0.51	-0.26
k7a1.0r1.0	328.15	-0.20	-0.22	-0.31	-0.62	-0.31	-0.43	-0.43	-0.47
k10a0.1r0.1	103.75	-1.58	-3.32	-1.06	0.00	-1.14	0.11	0.32	0.70
k10a0.1r0.3	103.08	-0.58	-1.44	-4.35	-4.49	-6.90	-7.14	-8.90	-14.45
k10a0.1r0.5	114.30	-1.01	-2.51	-0.96	-7.84	-11.58	-5.09	-8.23	-9.68
k10a0.1r0.7	90.72	-2.15	-2.05	-4.82	-3.75	-6.41	-5.09	-5.09	-7.05
k10a0.1r1.0	94.81	-4.38	-3.32	-5.75	-7.06	-8.54	-7.10	-7.49	-8.64
k10a0.3r0.1	247.26	-1.25	-1.05	-2.55	-1.75	-2.64	-2.21	-2.37	-2.65
k10a0.3r0.3	229.07	-1.56	-0.86	-1.38	-3.24	-1.45	-2.60	-3.12	-3.29
k10a0.3r0.5	215.19	-0.85	-0.76	-1.00	-1.01	-2.02	-2.11	-2.63	-4.30
k10a0.3r0.7	211.78	-0.52	-0.84	-2.02	-3.59	-4.64	-3.43	-4.33	-4.65
k10a0.3r1.0	225.40	0.34	-0.71	1.43	0.00	0.00	0.63	0.29	0.49
k10a0.5r0.1	357.76	-0.24	-0.30	-1.15	-1.45	-2.33	-2.18	-3.03	-4.89
k10a0.5r0.3	328.40	-0.63	-0.52	-0.63	-0.64	-0.97	-0.86	-1.29	-1.78
k10a0.5r0.5	315.88	-0.70	-0.66	-1.66	-2.02	-1.36	-1.85	-1.63	-1.70
k10a0.5r0.7	311.46	-0.82	-0.41	0.00	-0.34	-1.02	-0.61	-0.95	-1.70
k10a0.5r1.0	308.38	-0.43	-0.57	-0.67	0.35	0.35	0.07	0.35	0.71
k10a0.7r0.1	427.04	-0.24	-0.35	0.24	0.00	0.00	0.07	-0.15	-0.49
k10a0.7r0.3	433.96	-0.14	-0.31	-0.24	-0.48	-0.24	-0.41	-0.42	-0.34
k10a0.7r0.5	416.79	-0.60	-0.31	-0.74	-0.25	-1.01	-0.87	-1.26	-1.27
k10a0.7r0.7	385.41	-0.36	-0.41	-1.34	-2.17	-0.55	-1.47	-1.37	-0.97
k10a0.7r1.0	406.61	-0.27	-0.24	-0.25	0.51	0.00	-0.08	0.00	-0.52
k10a1.0r0.1	564.93	0.08	0.04	0.18	0.55	0.18	0.32	0.34	0.24
k10a1.0r0.3	512.12	-0.08	-0.04	-0.20	-0.59	0.20	-0.20	-0.08	0.30
k10a1.0r0.5	471.69	-0.22	-0.24	-0.22	-0.22	0.22	-0.13	0.04	0.22
k10a1.0r0.7	523.07	-0.14	-0.26	-0.20	-0.39	0.00	-0.22	-0.20	-0.20
k10a1.0r1.0	467.25	-0.46	-0.37	-0.43	-0.65	-1.53	-0.59	-0.79	-1.10
Average	163.75	-0.77	-0.76						

Table 1.18: Relative deviations for the Simheuristic best solutions (DevBest %). average of best solutions (AvgDev %). Value at Risk ($VaR\alpha$) and Conditional-Value-at-Risk ($CVaR\alpha$) with three levels of confidence (95%. 97.5% and 99%) in a PFSPDPST to a Simheuristic Sim BR-FF-VND in a PFSPDST with 1 minute stop time criterion and level of uncertainty of 2.0.

Bibliography

- [1] FERNANDEZ-VIAGAS, V.; FRAMINAN, J. M.. **A new set of high-performing heuristics to minimise flowtime in permutation flowshops.** Computers & Operations Research, 53:68–80, 2015.
- [2] PESSOA, L. S.; ANDRADE, C. E.. **Heuristics for a flowshop scheduling problem with stepwise job objective function.** European Journal of Operational Research, 266(3):950–962, 2018.