

# Anhang

Tabelle A-1	Numerische Auswertung MILP Szenario I .....	232
Tabelle A-2	Numerische Auswertung MILP Szenario II (1/4) .....	233
Tabelle A-3	Numerische Auswertung MILP Szenario II (2/4) .....	234
Tabelle A-4	Numerische Auswertung MILP Szenario II (3/4) .....	235
Tabelle A-5	Numerische Auswertung MILP Szenario II (4/4) .....	236
Tabelle A-6	Numerische Auswertung Heuristik Szenario I .....	237
Tabelle A-7	Numerische Auswertung Heuristik Szenario II (1/2) .....	238
Tabelle A-8	Numerische Auswertung Heuristik Szenario II (2/2) .....	239
Tabelle A-9	Vergleich Ergebnisse MILP mit Heuristik Szenario I .....	240
Tabelle A-10	Vergleich Ergebnisse MILP mit Heuristik Szenario II (1/2) .....	241
Tabelle A-11	Vergleich Ergebnisse MILP mit Heuristik Szenario II (2/2) .....	242

# A-1 Numerische Auswertung MILP Modell

## a. Szenario I

Tabelle A-1 Numerische Auswertung MILP Szenario I

Testinstanz	#Bedarfe	#Produktionselemente	#Ausgewählte Produktionselemente	#Konjunktionen	#Disjunktionen	#Kampagnen	Zeit für Netzwerkaufbau (sec)	Rechenzeit (sec)	# binäre Variablen	# Variablen	# Nebenbedingungen	Zielfunktion MILP	Anteil Rüst- und Reinigungskosten	Anteil Lagerkosten
TEST_1	1	14	8	16	0	8	2,66	0,05	88	255	1303	3.347.247,35	100%	0%
TEST_2	2	18	9	22	2	9	0,09	0,05	114	317	1873	3.367.148,97	100%	0%
TEST_3	3	28	16	34	6	16	0,16	0,03	184	513	4301	5.136.191,27	100%	0%
TEST_4	4	40	21	50	15	20	0,25	0,05	269	730	8067	6.071.880,37	100%	0%
TEST_5	5	52	29	66	33	20	0,31	0,06	339	836	10267	6.079.070,49	100%	0%
TEST_6	6	62	36	78	52	20	0,39	0,11	400	927	12101	6.081.175,85	100%	0%
TEST_7	7	74	41	94	80	20	0,48	0,08	480	1043	14321	6.086.392,39	100%	0%
TEST_8	8	86	49	110	114	20	0,59	0,09	566	1165	16553	6.103.674,80	99%	1%
TEST_9	9	96	56	122	148	20	0,66	0,16	642	1271	18417	6.107.768,50	99%	1%
TEST_10	10	108	61	138	195	20	0,92	0,14	741	1406	20675	6.113.299,78	99%	1%
TEST_11	11	120	69	154	245	20	0,94	0,22	843	1544	22939	6.139.273,07	99%	1%
TEST_12	12	130	76	166	294	20	1,11	0,39	934	1665	24833	6.141.536,62	99%	1%
TEST_13	13	142	81	182	360	20	1,23	0,52	1052	1819	27129	6.149.808,30	99%	1%
TEST_14	14	154	89	198	426	20	1,44	1,11	1170	1973	29425	6.195.057,42	98%	2%
TEST_15	15	158	90	204	446	20	1,52	0,52	1208	2023	30187	6.198.229,54	98%	2%
TEST_16	16	168	97	216	511	20	1,69	2,08	1315	2160	32113	6.207.595,39	98%	2%
TEST_17	17	180	102	232	597	20	1,91	0,59	1453	2334	34449	6.231.089,08	97%	3%
TEST_18	18	192	110	248	681	20	2,20	1,34	1589	2506	36781	6.284.940,75	97%	3%
TEST_19	19	202	117	260	761	20	2,67	1,66	1711	2658	38737	6.296.969,78	96%	4%
TEST_20	20	214	122	276	866	20	2,75	1,89	1868	2851	41111	6.311.345,82	96%	4%
TEST_21	21	226	130	292	966	20	3,45	5,55	2020	3039	43475	6.373.736,56	95%	5%
TEST_22	22	236	137	304	1061	20	3,38	5,14	2157	3206	45461	6.381.985,33	95%	5%
TEST_23	23	248	142	320	1185	20	3,83	8,84	2333	3418	47873	6.400.767,49	95%	5%
TEST_24	24	260	150	336	1301	21	4,30	17,80	2501	3622	50269	6.462.730,76	97%	3%
TEST_25	25	270	157	348	1411	21	4,89	12,66	2653	3804	52285	6.470.974,72	96%	4%
TEST_26	26	282	162	364	1554	20	5,30	27,88	2848	4035	54735	6.517.505,93	93%	7%
TEST_27	27	294	170	380	1686	21	5,59	78,83	3032	4255	57163	6.542.996,00	95%	5%
TEST_28	28	298	171	386	1724	21	5,83	64,69	3088	4323	57961	6.548.552,56	95%	5%
TEST_29	29	308	178	398	1850	22	6,27	178,66	3256	4521	60009	6.596.317,24	96%	4%
TEST_30	30	320	183	414	2013	21	7,36	147,97	3471	4772	62499	6.604.686,67	95%	5%

## b. Szenario II

Tabelle A-2 Numerische Auswertung MILP Szenario II (1/4)

Test Instanz	#Bedarfe	# Produktionselemente	#Ausgewählte Produktions Elemente	# Konjunktionen	# Disjunktionen	#Kampagnen	# Variablen	# binäre Variablen	# kontinuierliche Variablen	# Nebenbedingungen	CPLEX Rechenzeit-Schranke	CLPEX GAP limit	MIP GAP (%)
TEST_1	1	14	8	16	0	8	255	88	167	1303	7500	0,01	
TEST_2	2	18	9	22	2	9	317	114	203	1873	7500	0,01	
TEST_3	3	28	16	34	6	16	513	184	329	4301	7500	0,01	
TEST_4	4	40	21	50	15	20	730	269	461	8067	7500	0,01	
TEST_5	5	52	23	67	26	22	890	345	545	11626	7500	0,01	
TEST_6	6	62	29	80	27	28	1084	413	671	16884	7500	0,01	
TEST_7	7	67	31	87	30	29	1139	441	698	18584	7500	0,01	
TEST_8	8	79	39	103	48	29	1245	511	734	21720	7500	0,01	
TEST_9	9	89	46	115	69	29	1338	574	764	24338	7500	0,01	
TEST_10	10	101	51	131	105	29	1462	662	800	27510	7500	0,01	
TEST_11	11	113	53	148	140	29	1586	750	836	30685	7500	0,01	
TEST_12	12	123	59	161	152	29	1671	805	866	33289	7500	0,01	
TEST_13	13	128	61	168	161	29	1717	836	881	34599	7500	0,01	
TEST_14	14	140	69	184	195	29	1839	922	917	37767	7500	0,01	
TEST_15	15	150	76	196	233	29	1949	1002	947	40419	7500	0,01	
TEST_16	16	162	81	212	296	29	2100	1117	983	43645	7500	0,01	
TEST_17	17	174	83	229	355	29	2248	1229	1019	46868	7500	0,01	
TEST_18	18	184	89	242	378	29	2344	1295	1049	49494	7500	0,01	
TEST_19	19	189	91	249	393	29	2396	1332	1064	50816	7500	0,01	
TEST_20	20	201	99	265	443	29	2534	1434	1100	54016	7500	0,01	
TEST_21	21	211	106	277	498	29	2661	1531	1130	56702	7500	0,01	
TEST_22	22	223	111	293	588	29	2839	1673	1166	59982	7500	0,01	
TEST_23	23	235	113	310	671	29	3011	1809	1202	63253	7500	0,01	
TEST_24	24	245	119	323	705	30	3118	1886	1232	65901	7500	0,01	
TEST_25	25	250	121	330	726	29	3176	1929	1247	67235	7500	0,01	
TEST_26	26	262	129	346	792	29	3330	2047	1283	70467	7500	0,01	
TEST_27	27	266	130	352	812	29	3380	2085	1295	71541	7500	0,01	

Tabelle A-3 Numerische Auswertung MILP Szenario II (2/4)

Test Instanz	#Bedarfe	# Produktionselemente	#Ausgewählte Produktions Elemente	# Konjunktionen	# Disjunktionen	#Kampagnen	# Variablen	# binäre Variablen	# kontinuierliche Variablen	# Nebenbedingungen	CPLEX Rechenzeit-Schranke	CLPEX GAP limite	MIP GAP (%)
TEST_28	28	276	137	364	885	29	3525	2200	1325	74263	7500	0,01	
TEST_29	29	288	142	380	1003	29	3731	2370	1361	77599	7500	0,01	
TEST_30	30	300	145	397	1110	30	3927	2530	1397	80918	7500	0,01	
TEST_31	31	310	151	410	1155	30	4045	2618	1427	83588	7500	0,01	
TEST_32	32	315	153	417	1182	30	4109	2667	1442	84934	7500	0,01	
TEST_33	33	327	161	433	1266	31	4281	2803	1478	88202	7500	0,01	
TEST_34	34	337	168	445	1356	30	4443	2935	1508	90958	7500	0,01	
TEST_35	35	349	173	461	1501	30	4676	3132	1544	94348	7500	0,01	
TEST_36	36	361	175	478	1632	30	4896	3316	1580	97715	7500	0,01	1,96
TEST_37	37	371	181	491	1688	30	5025	3415	1610	100407	7500	0,01	1,95
TEST_38	38	376	183	498	1721	30	5095	3470	1625	101765	7500	0,01	1,97
TEST_39	39	386	189	511	1788	31	5280	3589	1691	111517	7500	0,01	1,97
TEST_40	40	398	197	527	1888	31	5468	3741	1727	115033	7500	0,01	3,01
TEST_41	41	408	204	539	1995	31	5647	3890	1757	118003	7500	0,01	1,98
TEST_42	42	420	209	555	2167	31	5907	4114	1793	121663	7500	0,01	2,23
TEST_43	43	432	213	572	2322	33	6151	4322	1829	125294	7500	0,01	2,23
TEST_44	44	442	219	585	2399	33	6301	4442	1859	128208	7500	0,01	2,02
TEST_45	45	447	221	592	2439	33	6378	4504	1874	129670	7500	0,01	2,09
TEST_46	46	459	229	608	2555	34	6582	4672	1910	133218	7500	0,01	2,52
TEST_47	47	469	236	620	2679	34	6778	4838	1940	136222	7500	0,01	1,94
TEST_48	48	481	241	636	2878	34	7065	5089	1976	139936	7500	0,01	2,40
TEST_49	49	493	243	653	3057	35	7333	5321	2012	143615	7500	0,01	3,63
TEST_50	50	503	249	666	3145	35	7494	5452	2042	146551	7500	0,01	3,27
TEST_51	51	508	249	673	3191	34	7577	5520	2057	148025	7500	0,01	4,01
TEST_52	52	520	257	689	3323	33	7797	5704	2093	151605	7500	0,01	2,06
TEST_53	53	524	260	695	3361	35	7865	5760	2105	152787	7500	0,01	4,01
TEST_54	54	534	265	707	3503	33	8079	5944	2135	155827	7500	0,01	4,52
TEST_55	55	546	272	723	3730	36	8394	6223	2171	159597	7500	0,01	5,39
TEST_56	56	558	274	740	3933	36	8686	6479	2207	163324	7500	0,01	5,32
TEST_57	57	568	278	753	4032	35	8858	6621	2237	166282	7500	0,01	5,87
TEST_58	58	573	280	760	4084	37	8947	6695	2252	167768	7500	0,01	4,45
TEST_59	59	583	288	773	4194	38	9130	6848	2282	170748	7500	0,01	5,09

Tabelle A-4 Numerische Auswertung MILP Szenario II (3/4)

Test Instanz	Zeit für Netzwerkaufbau (sec)	Rechenzeit (sec)	Zielfunktionswert	Anteil Rüst- und Reinigungskosten	Anteil Lagerkosten	Best Integer	Best Node
TEST_1	0,95	0,05	3.347.247,4	100,0%	0,0%	3.347.247,4	3.347.247,4
TEST_2	0,08	0,02	3.367.149,0	100,0%	0,0%	3.367.149,0	3.365.564,4
TEST_3	0,16	0,03	5.136.191,3	100,0%	0,0%	5.136.191,3	5.134.606,7
TEST_4	0,25	0,03	6.071.880,4	100,0%	0,0%	6.071.880,4	6.070.295,8
TEST_5	0,33	0,03	7.749.497,5	100,0%	0,0%	7.749.497,5	7.747.912,9
TEST_6	0,45	0,05	13.764.930,8	100,0%	0,0%	13.764.930,8	13.763.346,2
TEST_7	0,50	0,06	13.952.997,9	100,0%	0,0%	13.952.997,9	13.951.351,2
TEST_8	0,59	0,08	13.960.125,9	99,9%	0,1%	13.960.125,9	13.959.977,3
TEST_9	0,67	0,14	13.962.231,3	99,9%	0,1%	13.962.231,3	13.962.161,0
TEST_10	0,80	0,11	13.967.447,8	99,9%	0,1%	13.967.447,8	13.967.298,2
TEST_11	0,94	0,13	14.030.504,2	99,4%	0,6%	14.030.504,2	14.030.354,5
TEST_12	1,11	0,13	14.038.018,0	99,4%	0,6%	14.031.208,5	14.030.354,5
TEST_13	1,09	0,14	14.040.436,3	99,4%	0,6%	14.033.626,8	14.032.772,8
TEST_14	1,23	0,28	14.050.909,2	99,3%	0,7%	14.054.121,5	14.048.419,9
TEST_15	1,39	0,17	14.055.055,0	99,3%	0,7%	14.055.055,0	14.046.603,5
TEST_16	1,58	0,33	14.060.534,2	99,2%	0,8%	14.060.938,7	14.057.101,3
TEST_17	1,81	0,41	14.187.241,5	98,3%	1,7%	14.187.605,7	14.167.173,9
TEST_18	1,92	0,44	14.188.825,2	98,3%	1,7%	14.188.776,7	14.167.249,9
TEST_19	2,05	0,23	14.206.434,1	98,2%	1,8%	14.205.862,3	14.129.549,7
TEST_20	2,22	0,25	14.231.746,8	98,0%	2,0%	14.231.803,5	14.121.656,3
TEST_21	2,44	0,25	14.234.178,2	98,0%	2,0%	14.234.129,7	14.123.120,6
TEST_22	2,70	0,28	14.243.044,4	98,0%	2,0%	14.242.432,3	14.131.096,9
TEST_23	3,02	16,66	14.432.681,2	96,7%	3,3%	14.432.739,6	14.289.334,2
TEST_24	3,25	14,64	14.551.093,4	96,7%	3,3%	14.434.198,3	14.311.295,2
TEST_25	3,33	6,63	14.467.761,8	96,4%	3,6%	14.467.753,4	14.328.091,6
TEST_26	3,67	305,78	14.513.716,5	96,1%	3,9%	14.512.839,4	14.367.712,5
TEST_27	3,77	11,23	14.614.382,5	96,1%	3,9%	14.516.211,0	14.371.857,8

Tabelle A-5 Numerische Auswertung MILP Szenario II (4/4)

Test Instanz	Zeit für Netzwerkaufbau (sec)	Rechenzeit (sec)	Zielfunktionswert	Anteil Rüst- und Reinigungskosten	Anteil Lagerkosten	Best Integer	Best Node
TEST_28	4,00	21,17	14.526.305,3	96,0%	4,0%	14.579.945,9	14.436.052,2
TEST_29	4,39	590,73	14.548.970,5	95,9%	4,1%	14.549.019,2	14.403.554,3
TEST_30	4,98	15,64	14.550.257,9	95,9%	4,1%	14.549.021,2	14.406.952,3
TEST_31	5,17	8,31	14.551.843,1	95,9%	4,1%	14.550.402,4	14.416.521,1
TEST_32	5,34	5,92	14.597.108,9	95,6%	4,4%	14.597.345,8	14.547.307,2
TEST_33	5,70	7,72	14.664.857,5	95,3%	4,7%	14.652.678,1	14.566.746,6
TEST_34	6,06	3,98	14.661.787,1	95,2%	4,8%	14.664.612,2	14.580.507,6
TEST_35	6,72	13,58	14.678.417,3	95,0%	5,0%	14.679.315,0	14.581.267,5
TEST_36	7,34	7500,05	15.394.590,7	92,5%	7,5%	15.394.590,7	15.093.316,9
TEST_37	7,72	7500,02	15.400.382,0	92,4%	7,6%	15.400.381,9	15.099.804,4
TEST_38	7,95	7500,06	15.457.136,2	92,1%	7,9%	15.457.136,1	15.151.866,8
TEST_39	8,42	7500,03	15.498.846,1	92,1%	7,9%	15.498.852,0	15.193.196,1
TEST_40	8,88	7500,06	15.561.300,5	91,8%	8,2%	15.562.027,8	15.093.485,5
TEST_41	9,44	7500,08	15.569.257,0	91,7%	8,3%	15.569.257,0	15.261.363,3
TEST_42	10,17	7500,03	15.588.332,7	91,6%	8,4%	15.588.321,4	15.240.257,5
TEST_43	11,98	7500,09	15.732.791,5	91,6%	8,4%	15.732.784,9	15.381.249,4
TEST_44	12,02	7500,03	15.733.498,4	91,6%	8,4%	15.733.909,7	15.415.639,0
TEST_45	12,28	7500,11	15.816.442,7	91,1%	8,9%	15.816.449,3	15.485.687,1
TEST_46	12,83	7500,05	15.878.342,1	91,8%	8,2%	15.878.360,2	15.478.175,7
TEST_47	13,61	7500,02	15.886.650,0	91,8%	8,2%	15.888.738,7	15.581.054,4
TEST_48	15,11	7500,05	15.923.984,2	91,5%	8,5%	15.924.814,4	15.541.938,0
TEST_49	15,42	7500,06	16.468.601,0	93,7%	6,3%	16.431.639,7	15.834.791,2
TEST_50	16,58	7500,06	16.452.064,5	93,2%	6,8%	16.429.283,1	15.892.073,4
TEST_51	16,23	7500,06	16.453.357,9	94,2%	5,8%	16.451.427,0	15.791.450,6
TEST_52	17,23	7500,11	16.480.541,8	92,9%	7,1%	16.200.126,4	15.866.396,5
TEST_53	17,52	7504,15	16.595.209,7	94,2%	5,8%	16.491.721,0	15.830.113,1
TEST_54	20,33	7500,02	16.520.851,7	92,7%	7,3%	16.606.689,5	15.855.307,1
TEST_55	22,17	7500,05	16.555.055,2	94,4%	5,6%	16.586.281,9	15.692.412,8
TEST_56	21,47	7500,09	16.690.531,3	92,6%	7,4%	16.721.644,5	15.832.553,8
TEST_57	22,48	7500,03	17.569.555,7	92,1%	7,9%	16.678.417,5	15.699.113,5
TEST_58	22,39	7500,08	16.970.739,2	92,8%	7,2%	16.748.384,5	16.003.739,5
TEST_59	24,20	7500,09	16.764.855,1	93,6%	6,4%	16.848.554,1	15.990.297,2

## A-2 Numerische Auswertung Heuristik

### a. Szenario I

Tabelle A-6 Numerische Auswertung Heuristik Szenario I

Instance	# Bedarfe	# Produktionselemente	# Ausgewählte Produktionselemente	# Konjunktionen	# Disjunktionen	# Kampagnen	Zeit für Netzwerkaufbau (sec)	Rechenzeit Heuristik (sec)	Zielfunktionswert	Anteil Rüst- und Reinigungskosten	Anteil Lagerkosten
TEST_1	1	14	8	16	0	8	0,31	0,38	3.347.247,35	100%	0%
TEST_2	2	18	9	22	2	9	0,02	0,02	3.367.148,97	100%	0%
TEST_3	3	28	16	34	6	16	0,02	0,03	5.136.191,27	100%	0%
TEST_4	4	40	21	50	14	20	0,03	0,08	6.071.918,32	100%	0%
TEST_5	5	52	29	66	32	20	0,05	0,13	6.085.917,98	100%	0%
TEST_6	6	62	36	78	51	20	0,06	0,17	6.088.031,01	100%	0%
TEST_7	7	74	41	94	78	20	0,06	0,23	6.093.388,58	100%	0%
TEST_8	8	86	49	110	112	20	0,08	0,34	6.119.803,27	99%	1%
TEST_9	9	96	56	122	146	20	0,11	0,45	6.123.904,39	99%	1%
TEST_10	10	108	61	138	192	20	0,11	0,55	6.129.386,59	99%	1%
TEST_11	11	120	69	154	242	20	0,14	0,75	6.168.216,31	98%	2%
TEST_12	12	130	76	166	291	20	0,16	0,94	6.170.602,03	98%	2%
TEST_13	13	142	81	182	356	20	0,19	1,13	6.178.884,90	98%	2%
TEST_14	14	154	89	198	422	20	0,20	1,38	6.240.666,55	97%	3%
TEST_15	15	158	90	204	442	20	0,22	1,47	6.243.701,82	97%	3%
TEST_16	16	168	97	216	507	20	0,23	1,64	6.253.086,45	97%	3%
TEST_17	17	180	102	232	592	20	0,28	1,94	6.276.754,89	97%	3%
TEST_18	18	192	110	248	676	20	0,33	2,31	6.350.951,62	96%	4%
TEST_19	19	202	117	260	756	20	0,36	2,61	6.362.970,09	95%	5%
TEST_20	20	214	122	276	860	20	0,42	3,03	6.377.425,83	95%	5%
TEST_21	21	226	130	292	960	20	0,48	3,47	6.464.037,61	94%	6%
TEST_22	22	236	137	304	1055	20	0,53	4,02	6.471.998,10	94%	6%
TEST_23	23	248	142	320	1178	20	0,61	4,78	6.491.123,57	94%	6%
TEST_24	24	260	150	336	1294	21	0,69	5,11	6.491.926,09	96%	4%
TEST_25	25	270	157	348	1404	21	0,77	5,75	6.500.237,61	96%	4%
TEST_26	26	282	162	364	1546	21	0,86	6,41	6.537.727,66	95%	5%
TEST_27	27	294	170	380	1678	21	0,95	7,53	6.572.363,58	95%	5%
TEST_28	28	298	171	386	1716	21	0,98	7,88	6.577.823,12	95%	5%
TEST_29	29	308	178	398	1842	21	1,08	8,70	6.602.118,58	95%	5%
TEST_30	30	320	183	414	2004	21	1,22	9,11	6.623.383,24	94%	6%

## b. Szenario II

Tabelle A-7 Numerische Auswertung Heuristik Szenario II (1/2)

Instanz	# Aufträge	# Produktionselemente	# Ausgewählte Produktionselemente	# Konjunktionen	# Disjunktionen	# Kampagnen	Zeit für Netzwerkaufbau (sec)	Rechenzeit (sec)	Zielfunktionswert	Anteil Rüst- und Reinigungskosten	Anteil Lagerkosten
TEST_1	1	14	8	16	0	8	0,31	0,38	3.347.247,35	100%	0%
TEST_2	2	18	9	22	2	9	0,02	0,02	3.367.148,97	100%	0%
TEST_3	3	28	16	34	6	16	0,03	0,05	5.136.191,27	100%	0%
TEST_4	4	40	21	50	14	20	0,03	0,08	6.071.880,37	100%	0%
TEST_5	5	52	23	67	24	22	0,05	0,09	7.749.497,47	100%	0%
TEST_6	6	62	29	80	24	28	0,05	0,14	13.764.930,77	100%	0%
TEST_7	7	67	31	87	27	29	0,05	0,19	13.952.997,91	100%	0%
TEST_8	8	79	39	103	45	29	0,06	0,28	13.960.125,94	100%	0%
TEST_9	9	89	46	115	66	29	0,08	0,42	13.962.231,30	100%	0%
TEST_10	10	101	51	131	101	29	0,09	0,55	13.967.447,84	100%	0%
TEST_11	11	113	53	148	135	29	0,13	0,66	14.030.504,20	99%	1%
TEST_12	12	123	59	161	146	29	0,13	0,80	14.038.018,03	99%	1%
TEST_13	13	128	61	168	155	29	0,13	0,92	14.040.436,34	99%	1%
TEST_14	14	140	69	184	189	29	0,14	1,14	14.050.909,22	99%	1%
TEST_15	15	150	76	196	227	29	0,16	1,38	14.055.055,00	99%	1%
TEST_16	16	162	81	212	289	29	0,19	1,64	14.060.534,21	99%	1%
TEST_17	17	174	83	229	347	29	0,22	1,84	14.187.241,48	98%	2%
TEST_18	18	184	89	242	369	29	0,23	2,09	14.188.825,24	98%	2%
TEST_19	19	189	91	249	384	29	0,25	2,28	14.206.434,13	98%	2%
TEST_20	20	201	99	265	434	29	0,27	2,70	14.231.746,81	98%	2%
TEST_21	21	211	106	277	489	29	0,30	3,39	14.234.178,24	98%	2%
TEST_22	22	223	111	293	578	29	0,33	3,80	14.243.044,36	98%	2%
TEST_23	23	235	113	310	660	30	0,39	4,20	14.432.681,23	97%	3%
TEST_24	24	245	119	323	693	30	0,41	4,64	14.551.093,35	97%	3%
TEST_25	25	250	121	330	714	30	0,41	4,92	14.467.761,77	96%	4%
TEST_26	26	262	129	346	780	30	0,45	5,58	14.513.716,48	96%	4%
TEST_27	27	266	130	352	800	30	0,47	5,81	14.614.382,49	96%	4%
TEST_28	28	276	137	364	873	30	0,52	5,97	14.526.305,30	96%	4%
TEST_29	29	288	142	380	990	30	0,59	6,73	14.548.970,46	96%	4%
TEST_30	30	300	144	397	1096	30	0,66	9,42	14.550.257,89	96%	4%



Tabelle A-8 Numerische Auswertung Heuristik Szenario II (2/2)

Instanz	# Aufträge	# Produktionselemente	# Ausgewählte Produktionselemente	# Konjunktionen	# Disjunktionen	# Kampagnen	Zeit für Netzwerkaufbau (sec)	Rechenzeit (sec)	Zielfunktionswert	Anteil Rüst- und Reinigungskosten	Anteil Lagerkosten
TEST_31	31	310	150	410	1140	30	0,69	10,06	14.551.843,05	96%	4%
TEST_32	32	315	152	417	1167	30	0,72	10,55	14.597.108,94	96%	4%
TEST_33	33	327	160	433	1251	30	0,78	11,56	14.664.857,49	95%	5%
TEST_34	34	337	167	445	1341	30	0,84	12,92	14.661.787,05	95%	5%
TEST_35	35	349	172	461	1485	30	0,94	14,22	14.678.417,25	95%	5%
TEST_36	36	361	174	478	1615	31	1,05	15,16	15.394.590,68	92%	8%
TEST_37	37	371	180	491	1670	31	1,09	16,11	15.400.381,97	92%	8%
TEST_38	38	376	182	498	1703	31	1,13	16,61	15.457.136,20	92%	8%
TEST_39	39	386	188	511	1769	32	1,20	17,80	15.498.846,10	92%	8%
TEST_40	40	398	196	527	1869	32	1,30	19,25	15.561.300,48	92%	8%
TEST_41	41	408	203	539	1976	32	1,39	21,27	15.569.256,97	92%	8%
TEST_42	42	420	208	555	2147	32	1,56	25,19	15.588.332,72	92%	8%
TEST_43	43	432	210	572	2301	32	1,69	26,45	15.732.791,53	92%	8%
TEST_44	44	442	216	585	2377	32	1,80	27,84	15.733.498,36	92%	8%
TEST_45	45	447	218	592	2417	32	1,84	28,67	15.816.442,66	91%	9%
TEST_46	46	459	226	608	2533	33	1,98	28,30	15.878.342,11	92%	8%
TEST_47	47	469	233	620	2657	33	2,11	31,17	15.886.649,98	92%	8%
TEST_48	48	481	238	636	2855	33	2,36	33,70	15.923.984,21	92%	8%
TEST_49	49	493	240	653	3033	33	2,58	36,11	16.468.600,97	94%	6%
TEST_50	50	503	246	666	3120	33	2,72	37,84	16.452.064,51	93%	7%
TEST_51	51	508	248	673	3166	33	2,77	38,91	16.453.357,88	94%	6%
TEST_52	52	520	256	689	3298	33	2,92	45,14	16.480.541,76	93%	7%
TEST_53	53	524	257	695	3336	33	3,02	46,09	16.595.209,72	94%	6%
TEST_54	54	534	264	707	3478	33	3,22	49,36	16.520.851,68	93%	7%
TEST_55	55	546	269	723	3704	33	3,50	48,53	16.555.055,15	94%	6%
TEST_56	56	558	271	740	3906	33	3,77	50,83	16.690.531,30	93%	7%
TEST_57	57	568	277	753	4004	33	3,98	53,00	17.569.555,74	92%	8%
TEST_58	58	573	279	760	4056	34	4,03	59,44	16.970.739,15	93%	7%
TEST_59	59	583	285	773	4165	34	4,23	62,33	16.764.855,05	94%	6%

## A-3 Vergleich MILP Ansatz und Heuristik

### a. Szenario I

Tabelle A-9 Vergleich Ergebnisse MILP mit Heuristik Szenario I

Instanz	Zielfunktionswert MILP	Zielfunktionswert Heuristik	Abweichung Zielfunktionswert Heuristik von MILP (MILP = 100%)	# Kampagnen MILP	# Kampagnen Heuristik
TEST_1	3.347.247,35	3.347.247,35	100,00%	8	8
TEST_2	3.367.148,97	3.367.148,97	100,00%	9	9
TEST_3	5.136.191,27	5.136.191,27	100,00%	16	16
TEST_4	6.071.880,37	6.071.918,32	100,00%	20	20
TEST_5	6.079.070,49	6.085.917,98	100,11%	20	20
TEST_6	6.081.175,85	6.088.031,01	100,11%	20	20
TEST_7	6.086.392,39	6.093.388,58	100,11%	20	20
TEST_8	6.103.674,80	6.119.803,27	100,26%	20	20
TEST_9	6.107.768,50	6.123.904,39	100,26%	20	20
TEST_10	6.113.299,78	6.129.386,59	100,26%	20	20
TEST_11	6.139.273,07	6.168.216,31	100,47%	20	20
TEST_12	6.141.536,62	6.170.602,03	100,47%	20	20
TEST_13	6.149.808,30	6.178.884,90	100,47%	20	20
TEST_14	6.195.057,42	6.240.666,55	100,74%	20	20
TEST_15	6.198.229,54	6.243.701,82	100,73%	20	20
TEST_16	6.207.595,39	6.253.086,45	100,73%	20	20
TEST_17	6.231.089,08	6.276.754,89	100,73%	20	20
TEST_18	6.284.940,75	6.350.951,62	101,05%	20	20
TEST_19	6.296.969,78	6.362.970,09	101,05%	20	20
TEST_20	6.311.345,82	6.377.425,83	101,05%	20	20
TEST_21	6.373.736,56	6.464.037,61	101,42%	20	20
TEST_22	6.381.985,33	6.471.998,10	101,41%	20	20
TEST_23	6.400.767,49	6.491.123,57	101,41%	20	20
TEST_24	6.462.730,76	6.491.926,09	100,45%	21	21
TEST_25	6.470.974,72	6.500.237,61	100,45%	21	21
TEST_26	6.517.505,93	6.537.727,66	100,31%	20	21
TEST_27	6.542.996,00	6.572.363,58	100,45%	21	21
TEST_28	6.548.552,56	6.577.823,12	100,45%	21	21
TEST_29	6.596.317,24	6.602.118,58	100,09%	22	21
TEST_30	6.604.686,67	6.623.383,24	100,28%	21	21

## b. Szenario II

Tabelle A-10 Vergleich Ergebnisse MILP mit Heuristik Szenario II (1/2)

Instanz	Zielfunktionswert MILP	Zielfunktionswert Heuristik	Abweichung Zielfunktionswert Heuristik von MILP (MILP = 100%)	# Kampagnen MILP	# Kampagnen Heuristik
TEST_1	3.347.247,35	3.347.247,35	100,0%	8	8
TEST_2	3.367.148,97	3.367.148,97	100,0%	9	9
TEST_3	5.136.191,27	5.136.191,27	100,0%	16	16
TEST_4	6.071.880,37	6.071.918,32	100,0%	20	20
TEST_5	7.749.497,47	7.749.535,42	100,0%	22	22
TEST_6	13.764.930,77	13.764.968,72	100,0%	28	28
TEST_7	13.952.997,91	13.952.973,77	100,0%	29	29
TEST_8	13.960.125,94	13.966.973,43	100,0%	29	29
TEST_9	13.962.231,30	13.969.086,46	100,0%	29	29
TEST_10	13.967.447,84	13.974.444,03	100,1%	29	29
TEST_11	14.030.504,20	14.038.097,73	100,1%	29	29
TEST_12	14.038.018,03	14.038.804,42	100,0%	29	29
TEST_13	14.040.436,34	14.041.231,06	100,0%	29	29
TEST_14	14.050.909,22	14.067.645,75	100,1%	29	29
TEST_15	14.055.055,00	14.071.746,87	100,1%	29	29
TEST_16	14.060.534,21	14.077.229,07	100,1%	29	29
TEST_17	14.187.241,48	14.204.536,47	100,1%	29	29
TEST_18	14.188.825,24	14.205.548,54	100,1%	29	29
TEST_19	14.206.434,13	14.223.191,03	100,1%	29	29
TEST_20	14.231.746,81	14.262.020,75	100,2%	29	29
TEST_21	14.234.178,24	14.264.406,47	100,2%	29	29
TEST_22	14.243.044,36	14.272.689,34	100,2%	29	29
TEST_23	14.432.681,23	15.565.942,45	107,9%	29	30
TEST_24	14.551.093,35	15.567.462,06	107,0%	30	30
TEST_25	14.467.761,77	15.601.008,24	107,8%	29	30
TEST_26	14.513.716,48	15.662.789,89	107,9%	29	30
TEST_27	14.614.382,49	15.665.825,16	107,2%	29	30
TEST_28	14.526.305,30	15.675.209,79	107,9%	29	30
TEST_29	14.548.970,46	15.698.878,23	107,9%	29	30
TEST_30	14.550.257,89	16.131.857,44	110,9%	30	30

Tabelle A-11 Vergleich Ergebnisse MILP mit Heuristik Szenario II (2/2)

Instanz	Zielfunktionswert MILP	Zielfunktionswert Heuristik	Abweichung Zielfunktionswert Heuristik von MILP (MILP = 100%)	# Kampagnen MILP	# Kampagnen Heuristik
TEST_31	14.551.843,05	16.132.367,99	110,9%	30	30
TEST_32	14.597.108,94	16.178.851,35	110,8%	30	30
TEST_33	14.664.857,49	16.253.048,08	110,8%	31	30
TEST_34	14.661.787,05	16.265.066,55	110,9%	30	30
TEST_35	14.678.417,25	16.279.522,29	110,9%	30	30
TEST_36	15.394.590,68	16.771.552,78	108,9%	30	31
TEST_37	15.400.381,97	16.777.347,26	108,9%	30	31
TEST_38	15.457.136,20	16.834.136,59	108,9%	30	31
TEST_39	15.498.846,10	16.875.846,59	108,9%	31	32
TEST_40	15.561.300,48	16.962.458,36	109,0%	31	32
TEST_41	15.569.256,97	16.970.418,86	109,0%	31	32
TEST_42	15.588.332,72	16.989.544,32	109,0%	31	32
TEST_43	15.732.791,53	17.116.831,63	108,8%	33	32
TEST_44	15.733.498,36	17.117.545,41	108,8%	33	32
TEST_45	15.816.442,66	17.200.534,17	108,8%	33	32
TEST_46	15.878.342,11	17.201.336,69	108,3%	34	33
TEST_47	15.886.649,98	17.209.648,21	108,3%	34	33
TEST_48	15.923.984,21	17.247.138,26	108,3%	34	33
TEST_49	16.468.600,97	17.438.134,55	105,9%	35	33
TEST_50	16.452.064,51	17.442.204,75	106,0%	35	33
TEST_51	16.453.357,88	17.485.657,99	106,3%	34	33
TEST_52	16.480.541,76	17.520.293,91	106,3%	33	33
TEST_53	16.595.209,72	17.525.753,45	105,6%	35	33
TEST_54	16.520.851,68	17.550.048,92	106,2%	33	33
TEST_55	16.555.055,15	17.571.313,58	106,1%	36	33
TEST_56	16.690.531,30	17.826.018,84	106,8%	36	33
TEST_57	17.569.555,74	17.833.699,37	101,5%	35	33
TEST_58	16.970.739,15	17.862.330,03	105,3%	37	34
TEST_59	16.764.855,05	18.108.456,61	108,0%	38	34

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