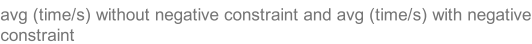


Data summary for using Gecode without negative constraint and without max fun constraint					
data	capacity	refill	fun	avg (time/s)	
basicData_number 4	5	2	[14,-10,4,-11]	0.254	
basicData_number 5	5	2	[9,-2,15,-12,4]	0.2376	
basicData_number 6	5	2	[-19,-6,-14,-15,8,-9]	0.2542	
basicData_number 7	5	2	[15,1,-8,-17,4,-20,10]	0.256	
basicData_number 8	5	2	[-14,12,6,-15,-6,-9,-1,-6]	0.4328	
basicData_number 9	5	2	[12,8,-17,9,6,3,-3,-11]	0.3632	
basicData_number 10	5	2	[11,-4,-8,-7,16,-4,14,-13,-11,1]	0.3174	
basicData_number 11	5	2	[-17,15,-13,17,-4,-16,9,-4,-6,-20,-10]	0.3122	
basicData_number 12	5	2	[18,-17,-18,13,-9,0,-18,0,-7,1,19,11]	0.761	
basicData_number 13	5	2	[19,-19,10,8,-19,-13,4,-1,15,-15,-10,-2,-4]	2.628	
basicData_number 14	5	2	[19,-2,0,-17,4,-15,0,9,15,-12,-15,15,-14,1]	19.53	
basicData_number 15	5	2	[-1,-10,2,-1,2,0,1,2,19,2,1,5,-3,12,-8]	84	
basicData_number 16	5	2	[19,19,-15,-9,-16,16,-13,14,-4,12,-6,1,13,8,-13,17]	424	
basicData_number 17	5	2	[-8,-12,2,-1,2,0,1,2,19,2,1,5,-3,12,-5,11,-8]	1740	
Data summary for using Gecode with negative constraint and without max fun constraint					
data	capacity	refill	fun	avg (time/s)	number of positive games
negative_constraint 4	5	2	[14,-10,4,-11]	0.11	2
negative_constraint 5	5	2	[9,-2,15,-12,4]	0.128	3
negative_constraint 6	5	2	[-19,-6,-14,-15,8,-9]	0.102	1
negative_constraint 7	5	2	[15,1,-8,-17,4,-20,10]	0.129	4
negative_constraint 8	5	2	[-14,12,6,-15,-6,-9,-1,-6]	0.109	2
negative_constraint 9	5	2	[12,8,-17,9,6,3,-3,-11]	0.131	6
negative_constraint 10	5	2	[11,-4,-8,-7,16,-4,14,-13,-11,1]	0.163	4
negative_constraint 11	5	2	[-17,15,-13,17,-4,-16,9,-4,-6,-20,-10]	0.111	3
negative_constraint 12	5	2	[18,-17,-18,13,-9,0,-18,0,-7,1,19,11]	0.134	7
negative_constraint 13	5	2	[19,-19,10,8,-19,-13,4,-1,15,-15,-10,-2,-4]	0.142	5
negative_constraint 14	5	2	[19,-2,0,-17,4,-15,0,9,15,-12,-15,15,-14,1]	0.184	7
negative_constraint 15	5	2	[-1,-10,2,-1,2,0,1,2,19,2,1,5,-3,12,-8]	0.192	10
negative_constraint 16	5	2	[19,19,-15,-9,-16,16,-13,14,-4,12,-6,1,13,8,-13,17]	0.31	9
negative_constraint 17	5	2	[-8,-12,2,-1,2,0,1,2,19,2,1,5,-3,12,-5,11,-8]	0.49	12
negative_constraint 18	5	2	[8,-10,-10,-8,14,0,-16,9,-6,18,9,-16,-5,-7,-8,12,16,-4]	0.262	9
negative_constraint 19	5	2	[-1,-5,-18,-16,-5,0,4,18,6,-16,9,3,14,10,17,-1,0,-4,-17]	0.257	11
negative_constraint 20	5	2	[17,-8,19,17,-9,18,20,1,19,-12,1,3,-2,5,4,-13,-11,-2,-12,-7]	1.962	11
negative_constraint 21	5	2	[-16,-11,-18,-14,15,-16,-16,6,15,16,1,19,15,4,13,19,-15,7,-7,-16,-1]	1.85	13
negative_constraint 22	5	2	[-5,10,-20,14,12,13,11,1,19,6,-13,7,3,14,-14,10,13,-2,14,-3,-11,-10]	180.023	14
negative_constraint 23	5	2	[15,-11,-18,-10,0,11,18,11,-7,-15,0,-19,19,7,-17,-5,17,-20,-16,-13,-12,-13,19]	0.187	10
negative_constraint 24	5	2	[-10,10,11,5,-17,14,5,-4,4,0,19,-17,-4,8,-10,-10,-14,-20,-2,12,-13,7,8]	120.009	13
negative_constraint 25	5	2	[-3,-15,19,9,-4,-12,3,5,-4,10,3,8,-12,10,14,6,9,2,17,14,12,-16,-3,0,6]	null	17
Data summary for using Chuffed with negative constraint and without max fun constraint					
data	capacity	refill	fun	avg (time/s)	total fun
chuffed_configuration 4	5	2	[14,-10,4,-11]	0.11	61
chuffed_configuration 5	5	2	[9,-2,15,-12,4]	0.04	100
chuffed_configuration 6	5	2	[-19,-6,-14,-15,8,-9]	0.03	-23
chuffed_configuration 7	5	2	[15,1,-8,-17,4,-20,10]	0.04	93
chuffed_configuration 8	5	2	[-14,12,6,-15,-6,-9,-1,-6]	0.04	21
chuffed_configuration 9	5	2	[12,8,-17,9,6,3,-3,-11]	0.05	103
chuffed_configuration 10	5	2	[11,-4,-8,-7,16,-4,14,-13,-11,1]	0.04	134
chuffed_configuration 11	5	2	[-17,15,-13,17,-4,-16,9,-4,-6,-20,-10]	0.04	76
chuffed_configuration 12	5	2	[18,-17,-18,13,-9,0,-18,0,-7,1,19,11]	0.04	192
chuffed_configuration 13	5	2	[19,-19,10,8,-19,-13,4,-1,15,-15,-10,-2,-4]	0.04	141
chuffed_configuration 14	5	2	[19,-2,0,-17,4,-15,0,9,15,-12,-15,15,-14,1]	0.05	192
chuffed_configuration 15	5	2	[-1,-10,2,-1,2,0,1,2,19,2,1,5,-3,12,-8]	0.05	167
chuffed_configuration 16	5	2	[19,19,-15,-9,-16,16,-13,14,-4,12,-6,1,13,8,-13,17]	0.06	349
chuffed_configuration 17	5	2	[-8,-12,2,-1,2,0,1,2,19,2,1,5,-3,12,-5,11,-8]	0.05	183
chuffed_configuration 18	5	2	[8,-10,-10,-8,14,0,-16,9,-6,18,9,-16,-5,-7,-8,12,16,-4]	0.06	273
chuffed_configuration 19	5	2	[-1,-5,-18,-16,-5,0,4,18,6,-16,9,3,14,10,17,-1,0,-4,-17]	0.07	271
chuffed_configuration 20	5	2	[17,-8,19,17,-9,18,20,1,19,-12,1,3,-2,5,4,-13,-11,-2,-12,-7]	0.25	303
chuffed_configuration 21	5	2	[-16,-11,-18,-14,15,-16,-16,6,15,16,1,19,15,4,13,19,-15,7,-7,-16,-1]	0.19	273
chuffed_configuration 22	5	2	[-5,10,-20,14,12,13,11,1,19,6,-13,7,3,14,-14,10,13,-2,14,-3,-11,-10]	3.7	366
chuffed_configuration 23	5	2	[15,-11,-18,-10,0,11,18,11,-7,-15,0,-19,19,7,-17,-5,17,-20,-16,-13,-12,-13,19]	0.06	315
chuffed_configuration 24	5	2	[-10,10,11,5,-17,14,5,-4,4,0,19,-17,-4,8,-10,-10,-14,-20,-2,12,-13,7,8]	0.17	266
chuffed_configuration 25	5	2	[-3,-15,19,9,-4,-12,3,5,-4,10,3,8,-12,10,14,6,9,2,17,14,12,-16,-3,0,6]	5.35	397
chuffed_configuration 26	5	2	[-4, 1, 1,-19, 16,-20, 5,-20, 9, 0,-5,-20, 16,-18, 12, 11, 17,-11,-5, 16,-5,-13,-9,-2,-8,-12]	0.07	216
chuffed_configuration 27	5	2	[-13, 11, 17,-11,-6, 19,-4, 18, 0,-16, 6,-20, 17, 2,-17,-18, 9, 9, 4,-14,-12,-1,-8, 0, 10, 17,-7]	0.12	367
chuffed_configuration 28	5	2	[5,-10,-12,-6, 7, 14,-8, 5, 14, 12,-8,-7, 9,-10, 3,-15,-17,-1, 1, 0, 7,-5,-14, 3, 9, 2,-4, 10]	0.14	251
chuffed_configuration 29	5	2	[17,-4, 7,-20,-8,-11,-10, 1,-1, 11, 6, 2,-14,-3,-7,-19, 0,-5,-20, 5, 16,-18,-17,-3, 1, 2, 6,-13,-18]	0.08	115
chuffed_configuration 30	5	2	[14,-4,-9, 20, 2, 20,-2,-7, 8, 1, 7, 2,-11,-8, 17, 9,-4,-7,-6, 2, 8,-19, 13, 5, 3, 6, 0,-12,-16, 5]	0.87	422
chuffed_configuration 31	5	2	[-6,-1, 18, 9, 15,-6,-2,-16, 16,-5, 0, 3, 8,-20,-13,-19, 11, 3, 11, 19, 2,-8,-18, 14, 9, 12, 4,-5, 8, 14, 1]	5.2	543
chuffed_configuration 32	5	2	[-7,-2, 12,-16, 13,-2,-16, 18, 11, 3,-18,-5, 11, 3, 7, 6,-13,-17,-13, 13, 5, 2,-18,-11, 18, 8,-15,-18,-]	0.27	276
chuffed_configuration 33	5	2	[-1,-17, 5, 4,-3,-18, 16,-12,-17,-17,-14,-14, 0,-16,-15, 20, 3, 4, 8, 4, 5,-6,-6, 7,-3,-13, 12, 11, 5,-]	0.16	163
chuffed_configuration 34	5	2	[-7, 13,-12,-6,-2, 15,-19,-1, 18, 3, 18,-5, 8,-15,-11,-19, 1, 9, 3, 4,-10, 15,-11, 12,-4,-20, 14,-11,-]	0.32	486
chuffed_configuration 35	5	2	[0, 14,-7, 2, 10, 4,-19, 14, 6, 14, 5,-11,-4, 9, 2, 3,-7, 9, 0, 14, 17, 20,-8, 1,-14, 20, 8,-15,-19,-16,-16]	25.13	497
chuffed_configuration 36	5	2	[-19, 8,-3,-3, 4,-13,-12, 11, 16, 8, 12, 7, 20,-16,-7,-5, 1,-6, 3,-6,-16, 14, 8,-9, 19, 6,-18, 19,-18,-1]	4.81	501
chuffed_configuration 37	5	2	[-20,-4, 3, 9,-9,-12,-19, 2, 7, 6,-20, 1, 3, 19,-11, 11,-1, 3,-13,-9,-1, 7,-2,-1, 4,-14,-5,-8, 20,-12, 3]	0.5	385
chuffed_configuration 38	5	2	[-17,-5,-13, 1, 14,-5,-19,-4,-11,-15, 9, 12, 19, 16, 6, 0,-6, 15,-1, 16, 14, 10,-8,-6,-13,-20, 6,-16, 1]	7.36	473
chuffed_configuration 39	5	2	[-20,-15, 17, 4, 4, 15, 3,-6,-6,-16,-5,-14,-16,-12, 17,-1,-14,-4, 0,-10, 20, 19, 16,-8,-19,-11, 1, 18,	1.43	494
chuffed_configuration 40	5	2	[-7, 16, 13,-18,-6,-18, 12, 4, 6, 4, 16,-7, 11, 15,-6,-18,-7,-17,-1, 11, 10,-5,-19, 0,-7, 15,-3, 14,-5,-]	null	null
Data summary for using c++					
data	capacity	refill	fun	avg (time/s)	
solverData_num 5	5	2	[4,-7, 17, 16,-11]	0.0000sec	
solverData_num 20	5	2	[14, 3,-12, 14, 18,-10,-19, 5,-14,-20, 2,-1, 12, 17, 3,-17, 2,-4,-8, 12]	0.0001sec	
solverData_num 30	5	2	[19,-11,-6, 15,-13, 17,-4, 4,-14,-1, 17, 18,-5, 15, 4, 9,-15,-1, 11,-9, 4,-13, 5,-17,-20,-13,-16,-4,-]	0.0001sec	
solverData_num 100	5	2	[-15, 9,-16, 4, 14, 10, 0, 5,-16,-2,-15, 5,-6,-8,-14, 20,-20,-14,-12,-3,-4, 16,-19, 15, 18,-8,-4, 1, 12]	0.001sec	
solverData_num 500	5	2	[-8,-17, 12,-20,-8, 10,-8, 12,-2, 15, 4, 16,-2,-19,-19,-15,-4,-10,-10, 7, 6, 14,-3,-20,-20, 13, 19]	0.002sec	
solverData_num 1000	5	2	[-13,-4,-7,-6,-16,-18,-7,-10,-18, 15, 3,-15, 19, 11, 2, 4, 1,-17,-4,-2,-2,-9,-2,-12,-1, 8, 16,-8,-8,-]	0.1sec	
solverData_num 5000	5	2	[10, 11,-1,-16,-6,-1,-17,-11, 0,-17,-20, 14,-1,-12, 20,-15, 6,-19,-14,-6,-2,-15, 8,-7,-9, 1,-2, 19,	0.5sec	
solverData_num 10000	5	2	[11,-4, 8,-3,-5,-8,-16,-13, 7, 14, 2, 13, 9,-2, 12, 16, 12,-6,-12, 6,-3,-5, 7, 1,-15, 4, 9, 13, 15,-5,-1, 7]	0.0000sec	

Data summary for comparing MiniZinc and c++ program			
data	MiniZinc solving time	MiniZinc output	solver output
lower_bound_compare_solver 50	1m12s	665	708
lower_bound_compare_solver 60	1m16s	580	581
lower_bound_compare_solver 70	26s731	1011	1099
lower_bound_compare_solver 80	27s882	900	1003
lower_bound_compare_solver 90	26s621	845	992
lower_bound_compare_solver 100	29s922	945	1063
lower_bound_compare_solver 110	18s81	1376	1567
lower_bound_compare_solver 120	27s432	1082	1265
lower_bound_compare_solver 130	49s237	1036	1205
lower_bound_compare_solver 140	31s98	1671	1948
lower_bound_compare_solver 150	49s790	1434	1647

Graph plot		
number of games	avg (time/s) negative	avg (time/s) negative constraint by using Chuffed
4	0.11	0.11
5	0.128	0.04
6	0.102	0.03
7	0.129	0.04
8	0.109	0.04
9	0.131	0.05
10	0.163	0.04
11	0.111	0.04
12	0.134	0.04
13	0.142	0.04
14	0.184	0.05
15	0.192	0.05
16	0.31	0.06
17	0.49	0.05
18	0.262	0.06
19	0.257	0.07
20	1.962	0.25
21	1.85	0.19
22	180.023	3.7
23	0.187	0.06
24	120.009	0.17
25	null	5.35



data summary by using Chuffed with negative constraint and with max fun constraint					avg (time/s)	total fun
data	capacity	refill	fun			
max_fun_constraint 4	5	2	[14,-0.4,-11]		0.04	61
max_fun_constraint 5	5	2	[9,-2.15,-12.4]		0.04	100
max_fun_constraint 6	5	2	[-19,-6,-14,-15.8,-9]		0.04	-23
max_fun_constraint 7	5	2	[15.1,-8,-17.4,-20.10]		0.04	93
max_fun_constraint 8	5	2	[-14,12.6,-15,-6,-9,-1,-8]		0.04	21
max_fun_constraint 9	5	2	[12.8,-17.9,6,6.3,-3,-11]		0.04	103
max_fun_constraint 10	5	2	[11,-4,-8,-7.16,-4.14,-13,-11.1]		0.04	134
max_fun_constraint 11	5	2	[-17.15,-13.17,-4,-16.9,-4,-6,-20,-10]		0.04	76
max_fun_constraint 12	5	2	[18,-17,-18.13,-9.0,-18.0,-7.1,19.11]		0.04	192
max_fun_constraint 13	5	2	[19,-19,10.8,-19,-13.4,-1.15,-15,-10,-2,-4]		0.05	141
max_fun_constraint 14	5	2	[19,-2.0,-17.4,-15.0,9.15,-12,-15.15,-14.1]		0.05	192
max_fun_constraint 15	5	2	[-1,-10.2,-1.2,0.1,2,19.2,1.5,-3,12,-5]		0.05	167
max_fun_constraint 16	5	2	[19,19,-15,-9,-16,16,-13.14,-4.12,-6.1,13.8,-13,17]		0.05	349
max_fun_constraint 17	5	2	[-8,-12.2,-1.2,0.1,2,19.2,1.5,-3,12,-5,11,-8]		0.05	183
max_fun_constraint 18	5	2	[8,-10,-10,-8,14.0,-16.9,-6,18.9,-16,-5,-7,-6,12,16,-4]		0.06	273
max_fun_constraint 19	5	2	[-1,-5,-18,-16,-5.0,4,18.6,-16.9,3,14,10,17,-1.0,-4,-17]		0.06	271
max_fun_constraint 20	5	2	[17,-8,19,17,-9,18,20,1.19,-12,1.3,-2.5,4,-13,-11,-2,-12,-7]		0.09	303
max_fun_constraint 21	5	2	[-16,-11,-18,-14,15,-16,-16.6,15,16.1,19,15.4,13.19,-15.7,-7,-16,-1]		0.08	273
max_fun_constraint 22	5	2	[-5,10,-20,14,12,13.11,1.9,6,-13.7,3.14,-14,10.13,-2.14,-3,-11,-10]		1.55	365
max_fun_constraint 23	5	2	[15,-11,-18,-10,0.11,18.11,-7,-15.0,-19,19.7,-17,-5,17,-20,-16,-13,-12,-13,19]		0.06	316
max_fun_constraint 24	5	2	[-10,10,11.5,-17,14.5,-4.4,4.0,19,-17,-4.8,-10,-10,-14,-20,-2,-12,-13,7,8]		0.11	266
max_fun_constraint 25	5	2	[-3,-15,19.9,4,-12.3,5,-4,10,3.8,-12,10,14,6.9,2,17,14,12,-16,-3,0,6]		1.61	397
max_fun_constraint 26	5	2	[-4,-1,1,-19,16,-20,5,-20,9,0,-5,-20,16,-18,12,11,17,-11,-5,16,-5,-13,-9,-2,-8,-12]		0.07	216
max_fun_constraint 27	5	2	[-13,11,17,-11,-6,19,-4,18,0,-16,6,-20,17,2,-17,-18,9,9,4,-14,-12,-1,-8,0,10,17,-1]		0.08	367
max_fun_constraint 28	5	2	[5,-10,-12,-6,7,14,-8,5,14,12,-8,-7,9,-10,3,-5,-17,-1,-1,0,7,-5,-14,3,9,2,-4,10]		0.07	251
max_fun_constraint 29	5	2	[17,-4,-7,-20,-8,-11,-10,1,-1,11,6,2,-14,-3,-7,-19,0,-5,-20,5,16,-18,-17,-3,-1,2,6,-13,-18]		0.07	115
max_fun_constraint 30	5	2	[14,-4,-9,20,2,20,-2,-2,8,1,7,2,-11,-8,17,9,-4,-7,-6,2,8,-19,13,5,3,6,0,-12,-16,5]		0.14	422
max_fun_constraint 31	5	2	[-6,-1,18,9,15,-6,-2,-16,16,-5,0,3,8,-20,-13,-19,11,3,11,19,2,-8,-18,14,9,12,4,-5,8,14,1]		5.68	543
max_fun_constraint 32	5	2	[-7,-2,-12,-16,13,-2,-16,18,11,3,-18,-5,11,3,7,6,-13,-17,-13,13,5,2,-18,-11,18,8,-15,-18,-]		0.1	276
max_fun_constraint 33	5	2	[-1,-17,5,4,-3,-18,16,-12,-17,-17,-14,-14,-14,-16,-15,20,3,4,8,4,5,6,-6,-7,-3,-13,12,11,5,-]		0.11	163
max_fun_constraint 34	5	2	[-7,13,-12,-6,-2,15,19,-1,-18,3,17,-18,-5.8,-15,-11,-19,1.9,3,4,-10,15,-11,12,-4,-20,14,-11,-]		0.28	489

max_fun_constraint 35	5	2	[0, 14, -7, 2, 10, 4, -19, 14, 6, 14, 5, -11, -4, 9, 2, 3, -7, 9, 0, 14, 17, 20, -8, 1, -14, 20, 8, -15, -19, -16, -16]	11.27	497
max_fun_constraint 36	5	2	[-19, 8, -3, -3, 4, -13, -12, 11, 16, 8, 12, 7, 20, -16, -7, -5, 1, -6, 3, -6, -16, 14, 8, -9, 19, 6, -18, 19, -18, -18]	5.5	501
max_fun_constraint 37	5	2	[-20, -4, 3, 9, -9, -12, -19, 2, 7, 6, -20, 1, 3, 19, -11, 11, -1, 3, -13, -9, -1, 7, -2, -1, 4, -14, -5, -8, 20, -12, 3]	0.37	385
max_fun_constraint 38	5	2	[-17, -5, -13, 1, 14, -5, -19, -4, -11, -15, 9, 12, 19, 16, 6, 0, -6, 15, -1, 16, 14, 10, -8, -6, -13, -20, 6, -16, 17]	4.1	473
max_fun_constraint 39	5	2	[-20, -15, 17, 4, 4, 15, 3, -6, -6, -16, -5, -14, -16, -12, 17, -1, -14, -4, 0, -10, 20, 19, 16, -8, -19, -11, 1, 18, -1]	0.2	494
max_fun_constraint 40	5	2	[-7, 16, 13, -18, -6, -18, 12, 4, 6, 4, 16, -7, 11, 15, -6, -18, -7, -17, -1, 11, 10, -5, -19, 0, -7, 15, -3, 14, -5, 1]	92.74	595

Graph plot

number of games	avg (time/s) time without using max fun constraint	avg (time/s) with max fun constraint
4	0.11	0.04
5	0.04	0.04
6	0.03	0.04
7	0.04	0.04
8	0.04	0.04
9	0.05	0.04
10	0.04	0.04
11	0.04	0.04
12	0.04	0.04
13	0.04	0.05
14	0.05	0.05
15	0.05	0.05
16	0.06	0.05
17	0.05	0.05
18	0.06	0.06
19	0.07	0.06
20	0.25	0.09
21	0.19	0.08
22	3.7	1.55
23	0.06	0.06
24	0.17	0.11
25	5.35	1.61
26	0.07	0.07
27	0.12	0.08
28	0.14	0.07
29	0.08	0.07
30	0.87	0.14
31	5.2	5.68
32	0.27	0.1
33	0.16	0.11
34	0.32	0.28
35	25.13	11.27
36	4.81	5.5
37	0.5	0.37
38	7.36	4.1
39	1.43	0.2
40	null	92.74

