A Benchmark Suite of Designing Combinational Circuits for Metaheuristics
–Supplementary Material–

Problem	Method	Objective Function Evaluations					SR
		Best	Median	Mean	std	Worst	
C17	SAM	537	2449	3648.6	3.09E+3	15381	100%
	SAMGAM	985	2827	3452.6	2.76E+3	15829	100%
cm42a	SAM	14973	47443	47809.13	2.14E+4	94445	100%
	SAMGAM	15233	32233	34453	1.30E+4	74317	100%
cm82a	SAM	4209	20449	29863.4	2.52E+4	111693	100%
	SAMGAM	2141	21887	29519.67	2.79E+4	132801	100%
cm138a	SAM	91673	267871	340928.6	2.00E+5	874629	100%
	SAMGAM	47017	230203	234970.07	1.15E+5	444293	100%
decod	SAM	247385	662897	815335.13	3.66E+5	1807937	100%
	SAMGAM	174469	522755	525333.13	1.67E+5	880633	100%
f51m	SAM	436061	3292863	3911038.33	2.81E+6	11605521	100%
	SAMGAM	869069	1987763	2825418.6	2.49E+6	13699465	100%
majority	SAM	553	5469	6024.73	4.57E+3	24049	100%
	SAMGAM	881	5727	7475.8	5.04E+3	19373	100%
z4ml	SAM	21125	199311	211209.8	1.26E+5	482489	100%
	SAMGAM	37177	169565	175415.53	1.09E+5	463185	100%
9symml	SAM	260961	1312549	1910357.27	1.95E+6	9904521	100%
	SAMGAM	287253	879337	1534274.93	1.16E+6	4211029	96.67%
alu2	SAM	7789921	11384439	11384439	3.59E+6	14978957	6.67%
	SAMGAM	6769625	10727973	10727973	3.96E+6	14686321	6.67%
alu4	SAM	3701493	11510149	13280590.71	7.03E+6	29996993	93.33%
	SAMGAM	3992305	14487059	14510074.17	6.32E+6	29470237	80%
cm85a	SAM	243657	550441	767037.53	4.91E+5	1744525	100%
	SAMGAM	115889	446549	459062.73	2.10E+5	948757	100%
cm151a	SAM	37381	102293	115905.27	5.87E+4	288277	100%
	SAMGAM	27669	82869	89276.07	5.16E+4	313185	100%
cm162a	SAM	107529	590447	719636.87	4.90E+5	2164477	100%
	SAMGAM	108253	549991	690885.13	4.53E+5	2102365	100%
cu	SAM	1370421	3816927	5251121.8	3.54E+6	16369761	100%
	SAMGAM	669961	1847761	2200875.13	1.49E+6	8138929	100%
x2	SAM	576321	2524951	2491313.4	1.20E+6	4854317	100%
	SAMGAM	296409	1631289	1693991.27	9.23E+5	3900609	100%

Problem	Method	Objective Function Evaluations					SR
		Best	Median	Mean	std	Worst	
cmb	SAM	23511441	28264511	28264511	4.75E+6	33017581	6.67%
	SAMGAM	-	-	-	-	-	-
cc	SAM	1882385	3294157	3996353.93	1.99E+6	8951897	100%
	SAMGAM	1298041	2567215	3100726.6	1.46E+6	7358305	100%
cordic	SAM	-	-	-	-	-	-
	SAMGAM	-	-	-	-	-	-
frg1	SAM	1853873	5785037	6074773.67	3.31E+6	17084041	100%
	SAMGAM	1775569	5215517	5942857	2.93E+6	15155953	100%
pm1	SAM	1791033	9210735	9425300.2	5.84E+6	31629077	100%
	SAMGAM	4663709	8483397	10512222.38	6.09E+6	33652345	96.67%
sct	SAM	10387633	21393861	23471243.61	9.68E+6	43430233	76.67%
	SAMGAM	4950305	17676175	19484299	1.02E+7	36316165	86.67%
t481	SAM	50921	215303	395462.2	4.04E+5	1782541	100%
	SAMGAM	32781	243109	356941.4	3.06+5	1439417	100%
tcon	SAM	86445	290285	323715.53	1.83E+5	845041	100%
	SAMGAM	47809	114269	129388.07	5.75E+4	270465	100%
vda	SAM	-	-	-	-	-	-
	SAMGAM	-	-	-	-	-	-

Problem	C17	*cm42a	cm82a	cm138a	*decod	f51m	majority	z4ml	9symml	alu2	alu4	*cm85a
p-value	0.8360	0.0081	0.9646	0.0546	0.0007	0.0760	0.2612	0.2739	0.8556	0.4386	0.4517	0.0428

Problem	*cm151a	cm162a	*cu	*x2	cmb	cc	cordic	frg1	pm1	sct	t481	*tcon	vda
p-value	0.0459	0.9176	8.01E-06	0.0093	-	0.0811	-	0.9528	0.6275	0.1731	0.7788	2.89E-07	-

Table 1: Time elapsed during the execution of experiment 1 for all problems.

Problem	Method	Total Time (s)
C17	SAM	45.17
	SAMGAM	38.48
cm42a	SAM	99.62
	SAMGAM	105.38
cm82a	SAM	37.89
	SAMGAM	37.63
cm138a	SAM	210.99
	SAMGAM	194.10
decod	SAM	279.13
	SAMGAM	280.43
f51m	SAM	297.60
	SAMGAM	363.55
majority	SAM	22.71
	SAMGAM	19.35
z4ml	SAM	160.08
	SAMGAM	138.97
9symml	SAM	2227.19
	SAMGAM	2940.04
alu2	SAM	7240.35
	SAMGAM	7978.08
alu4	SAM	31974.36
	SAMGAM	33917.17
cm85a	SAM	711.43
	SAMGAM	732.04
cm151a	SAM	3606.72
	SAMGAM	2989.30
cm162a	SAM	2180.30
	SAMGAM	2104.35
cu	SAM	2403.53
	SAMGAM	1927.48
x2	SAM	1010.07
	SAMGAM	948.42

Problem	Method	Total Time (s)
cmb	SAM	6705.72
	SAMGAM	8240.09
cc	SAM	12699.49
	SAMGAM	14177.15
cordic	SAM	9942.42
	SAMGAM	8300.34
frg1	SAM	14104.51
	SAMGAM	12616.93
pm1	SAM	3994.71
	SAMGAM	4229.30
sct	SAM	7510.82
	SAMGAM	9874.53
t481	SAM	1726.56
	SAMGAM	1163.29
tcon	SAM	5477.06
	SAMGAM	6144.84
vda	SAM	139480.11
	SAMGAM	195757.12

Problem	Method	First Feasible Solution									Optimized Solution								
		AND	OR	NOT	NAND	NOR	XOR	XNOR	TOTAL	depth	AND	OR	NOT	NAND	NOR	XOR	XNOR	TOTAL	depth
C17	SAM	5.47	3.33	2.9	3.47	3.23	2.47	3.37	24.23	9.27	2.63	0.1	0.73	0.6	0.77	0	0	4.83	3.97
	SAMGAM	4.77	3.43	3.33	4.27	4	3.07	3.57	26.43	10.33	1.9	0.17	0.97	1	1.3	0.03	0	5.37	4
cm42a	SAM	5.97	12.43	5.67	10.5	7.37	6.73	7.13	55.8	11.67	0.67	3.93	0.87	8	6.53	0.17	0.07	20.23	6.27
	SAMGAM	7.07	10.33	6.13	11.63	7.77	7.53	6.23	56.7	12.13	1.4	3.63	0.8	8.17	5.7	0.43	0.33	20.47	6.73
cm82a	SAM	3.23	3.23	3.8	3.57	3.03	5.73	6.33	28.93	10.3	0.97	0.63	1	1.27	3.27	4.53	1.1	12.77	7.9
	SAMGAM	3.6	3.8	4.4	3.93	3.47	6.43	6.83	32.47	10.3	1	0.933	1.07	1.37	3.47	4.27	0.93	13.03	7.93
cm138a	SAM	6.6	11.07	5.13	10.03	8.17	5.4	5.17	51.57	12.37	1.57	3.3	1.8	7.07	5.6	0.2	0.13	19.67	8.13
	SAMGAM	7.3	10.37	5.57	11.1	7.43	5.5	6	53.27	12.07	1.73	3.13	1.53	6.9	5.93	0.23	0.13	19.6	7.83
decod	SAM	14.47	7.73	5.6	9.37	15.6	7.7	7.7	68.17	12.23	5.83	2.47	3.03	3.97	18.63	0.77	0.93	35.63	8.13
	SAMGAM	16.53	7.73	6.37	9.7	14.27	7.83	7.77	70.2	12.63	7.83	2.83	2.47	3.87	18.37	0.77	1.03	37.17	9.37
f51m	SAM	4.37	4.27	5.9	4.7	3.8	12.77	12.33	48.13	12.67	3.07	3.1	3.7	3.37	4.4	14.03	5.1	36.77	11.8
	SAMGAM	6.13	6	6.33	4.47	4.67	13.1	13	53.7	12.8	4.17	4.33	4.2	3.4	5.43	13.5	6.97	42	12.07
majority	SAM	3.2	3.43	2.27	3.53	2.7	2.7	2.83	20.67	9.8	0.67	1.17	0.13	1.9	4.4	0.23	0.07	8.57	5.77
	SAMGAM	3.03	3.27	1.83	2.77	3.17	1.93	2.6	18.6	9.5	1.37	1.1	0.33	1.2	4.77	0.17	0.03	8.97	6.13
z4ml	SAM	4.17	3.87	5.03	3.5	4.2	8.3	7.7	36.77	11.3	1.87	1.37	1.73	1.7	4.3	6.97	2.47	20.4	9.73
	SAMGAM	3.63	4.3	4.8	3.43	3.17	8.73	7.93	36	10.87	1.9	1.77	1.47	1.43	4.2	7.9	2.3	20.97	9.97
9symml	SAM	12.43	12	9	12.07	12.3	15.67	14.6	87.97	17.77	7.77	7.7	3.73	7.7	12.1	11.43	7.36	57.8	15.93
	SAMGAM	12.31	13.66	8.79	13.97	11.69	15.38	14.69	90.48	18.21	7.69	8.38	4.10	8.59	11.72	10.14	7.10	57.72	16
alu2	SAM	28.5	20	17.5	31.5	31.5	31	28.5	188.5	20.5	21	21	15	24	31	24.5	19	155.5	20.5
	SAMGAM	31.5	31.5	26.5	31.5	30	29.5	35.5	216	21	25.5	27	19	26.5	29.5	16.5	20.5	164.5	19
alu4	SAM	21.68	21.25	24.64	23.5	23	23	22.07	159.14	18.82	14.96	13.86	16.11	15.07	21.57	14.46	10.32	106.36	16.61
	SAMGAM	25.25	25.21	27.58	27.71	26	27.58	26	185.33	20.04	16.83	15.75	18.33	16.75	24.96	16.17	13.92	122.71	17.79
cm85a	SAM	10.97	10.97	11.87	10.57	9.5	8.77	9.77	72.4	16.03	4.03	3.83	3.2	4.2	10.07	2.57	1.53	29.43	12.37
	SAMGAM	13.37	15.6	13.87	15.1	14	12.03	12.07	96.03	16.8	3.3	4.57	3.83	5.3	9.97	2.53	1.57	31.07	12.37
cm151a	SAM	11.53	12.57	9.1	11.4	12.63	8	9	74.23	16.63	3.7	3.1	2.77	4.37	13.5	1.47	0.8	29.7	11.77
	SAMGAM	10.93	12.93	9.13	11.93	13.13	8.93	8.9	75.9	16.57	4.43	3.1	2.27	3.97	13.4	1.23	0.63	29.03	11.57
cm162a	SAM	17.13	13.93	14.9	16.93	13.17	12.9	12.7	101.67	15.37	6.87	4	4.53	5.9	11.43	3.5	1.47	37.7	11.1
	SAMGAM	17.43	14.3	17	16.8	15.07	12.97	12.53	106.1	16.43	6.4	4.73	4.83	6.33	11.17	3.47	1	37.93	11.47
cu	SAM	19.63	18.6	19.03	17.4	20.2	13.2	12.93	121	16.77	7.1	4.93	4.9	4.53	17.17	2.3	1.17	42.1	10.93
	SAMGAM	24.47	22.2	21.53	20.23	23.5	17.2	16.93	146.07	17.33	8.47	4.27	5.1	5.9	15.63	2.27	0.63	42.27	11.3
x2	SAM	16.57	18.57	15.73	17.43	15.67	13.3	12	109.27	17.2	4.47	6.5	4.23	6.67	11.3	2.03	1.33	36.53	11.7
	SAMGAM	19.43	18.17	17.67	19.87	16.17	15.3	14.8	121.4	16.83	6.17	4.87	4.53	6.83	11.67	1.97	1.07	37.1	11.53

Problem	Method	First Feasible Solution									Optimized Solution								
		AND	OR	NOT	NAND	NOR	XOR	XNOR	TOTAL	depth	AND	OR	NOT	NAND	NOR	XOR	XNOR	TOTAL	depth
cmb	SAM	37	32	24.5	28	29	27	25.5	203	19	11.5	5	5	4	8	0	0	33.5	8.5
	SAMGAM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cc	SAM	39.57	32.9	39.23	36.8	37.7	31.5	32.4	250.1	19.07	10.5	5.8	10.2	5.57	16.9	2.53	2.03	53.53	9.46
	SAMGAM	49.23	41.57	48.37	42.07	43.73	41.17	38.8	304.93	20.9	11.13	6.43	12.5	5.27	16.17	2.5	2.53	56.53	9.76
cordic	SAM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SAMGAM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
frg1	SAM	21.3	13.13	11.83	17.5	13.5	4.53	4.3	86.1	16.23	17.6	7.73	4.23	11.93	13.4	0.9	0.47	56.27	13.7
	SAMGAM	20.07	13.83	12.17	17.23	12.03	4.53	4.5	84.37	15.83	18.87	8.07	4.53	12.93	12.8	0.67	0.3	56.17	13.3
pm1	SAM	21.97	19.2	24.7	21.9	18.3	15.03	14.27	135.37	16.37	7.47	3.27	8.83	6.27	8.87	1.53	0.37	36.6	9.4
	SAMGAM	25.62	22.31	26.97	25.9	24.28	17.24	19.83	162.14	17.21	7.76	4	10.28	5.48	9.34	1.28	0.38	38.52	10.14
sct	SAM	28.22	28.61	34.87	29.43	28.22	24.57	25.22	199.13	20.13	7.65	6.26	11.61	6.83	13.69	5.61	3.43	55.09	14.87
	SAMGAM	33.27	36.04	41.65	36.27	34.62	33.58	32.04	247.46	21.27	7.73	7.58	14.5	5.96	13.35	5.58	3.58	58.27	15.42
t481	SAM	9.7	8.57	13.33	10.33	10.07	12.2	11.37	75.57	15.33	2.83	2.9	7.67	3.13	6.47	6.43	3.03	32.47	9.83
	SAMGAM	9.7	10.03	14.13	10.4	10.03	11.97	11.03	77	15	2.33	2.77	7.77	3.23	6.9	5.93	3.03	31.97	10.27
tcon	SAM	33	31.97	37.17	34.47	34.47	32.23	32.5	235.8	19.37	3.2	2.17	3.97	2.57	13.7	2.17	1.03	28.8	5.1
	SAMGAM	43.77	39.5	46.63	42.13	39.77	38.63	38.13	288.57	20.47	3.83	3.23	4.73	2.93	11.97	1.57	0.97	29.23	5
vda	SAM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SAMGAM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 2: População Inicial com Circuito Factível (FFS: primeira solução factível. Value: número de transistores da solução inicial. Gates: número de portas lógicas. RR: redução relativa)

Problem	Method	FFS	Best Solution									p-value
		Value	Min	Median	Mean	std	Max	Gates	Depth	RR (%)	Time (s)	
C17	PM	12	12	12	12	**0**	12	6	**4**	0	**14.95**	1.05E-27
	SAM		**8**	**8**	**8**	**0**	**8**	**4**	**4**	**33.33**	21.49	
cm42a	PM	156	**30**	36	35.5	**2.55**	42	21.48	**6.45**	**77.24**	**167.68**	4.85E-1
	SAM		31	**35**	**35.27**	2.71	**41**	**21.45**	6.58	77.38	175.41	
cm82a	PM	159	**18**	22	**21.83**	**1.99**	**28**	**11.52**	**8.12**	86.27	**70.42**	9.79E-1
	SAM		19	**21**	22.55	3.42	36	13.18	8.58	**85.82**	87.22	
cm138a	PM	148	33	39	**38.47**	**2.67**	**42**	**23.48**	**7.97**	**74.01**	**307.72**	8.89E-1
	SAM		**32**	**38**	38.58	2.89	46	23.72	8.32	73.92	339.59	
decod	PM	132	59	68.5	**68.27**	**5.01**	**80**	**37.85**	**7.5**	**48.28**	**247.95**	9.71E-1
	SAM		**56**	**67.5**	68.65	7.95	90	38.73	7.57	47.99	277.76	
f51m	PM	638	638	638	638	**0**	638	323	29	0	3416.41	5.51E-24
	SAM		**301**	**422.5**	**413.67**	27.67	**449**	**214.38**	**23.4**	**35.16**	**2066.96**	
majority	PM	24	13	16	16.6	2.18	22	9.07	6.43	30.83	**15.27**	2.98E-7
	SAM		**11**	**14**	**14.43**	**2.04**	**20**	**8.6**	**6.27**	**39.86**	17.39	
z4ml	PM	503	499	503	502.93	0.51	503	254.97	33	0.01	1841.58	7.92E-24
	SAM		**33**	**86**	**90.7**	**42.49**	**223**	**49.85**	**15.27**	**81.97**	**1099.39**	
9symml	PM	1039	1039	1039	1039	**0**	1039	524	92	0	5827.1	1.14E-12
	SAM		**197**	**251**	**260.1**	47.55	**367**	**140.97**	**22.5**	**74.96**	**4816.67**	
alu2	PM	1790	1790	1790	1790	**0**	1790	900	74	0	**10799.5**	5.53E-24
	SAM		**497**	**621**	**623.35**	54.87	**746**	**323.7**	**60.68**	**65.18**	108494.94	
cm85a	PM	610	610	610	610	**0**	610	309	25	0	2435.07	5.46E-24
	SAM		**43**	**59.5**	**66.4**	20.22	**106**	**38.9**	**17.65**	**89.11**	**1672.06**	
cm151a	PM	154	43	53.5	53.32	**3.80**	**59**	**31.4**	12.13	65.38	3407.18	8.00E-4
	SAM		**40**	**50.5**	**51**	4.00	**59**	31.55	**12.02**	**66.88**	**1951.36**	
cm162a	PM	200	**57**	66	66.53	4.32	**78**	**40.22**	**11.98**	66.73	1954.96	6.03E-1
	SAM		59	**65**	**66.02**	**3.72**	79	40.62	12.22	**66.97**	**1436.06**	
cu	PM	261	64	75.5	75.23	5.32	87	46.83	12.73	71.17	2443.44	1.70E-2
	SAM		**63**	**72**	**71.93**	**4.47**	**82**	**46.07**	**12.47**	**72.44**	**1825.51**	
x2	PM	174	56	**63**	**63.32**	**2.24**	**67**	**37.88**	13.08	**63.61**	853.62	3.85E-2
	SAM		**55**	65	64.18	3.13	73	39.02	**12.58**	63.08	**652.36**	

Table 3: População Inicial com Circuito Factível (FFS: primeira solução factível. Value: número de transistores da solução inicial. Gates: número de portas lógicas. RR: redução relativa)

Problem	Method	FFS	Best Solution									p-value
		Value	Min	Median	Mean	std	Max	Gates	Depth	RR (%)	Time (s)	
cmb	PM	144	**44**	**58.5**	**59.03**	10.84	**77**	**34.42**	**10.45**	**59.00**	743.39	2.70E-3
	SAM		46	65	64.93	**7.86**	**77**	38.52	12.28	54.91	**680.97**	
cc	PM	256	86	101	101.28	**7.54**	130	55.27	**8.77**	**60.44**	3140.75	1.78E-12
	SAM		**75**	**90**	**89.63**	**7.54**	**105**	**51.12**	8.98	64.99	**1998.02**	
frg1*	PM	1605	1605	1605	1605	**0**	1605	816	116	0	189285.26	7.56E-12
	SAM		**238**	**359**	**357.73**	49.98	**441**	**194.87**	**24.93**	**77.71**	**37918.36**	
pm1	PM	2084	2084	2084	2084	**0**	2084	1050	45	0	27840.60	5.14E-24
	SAM		**74**	**83**	**83.72**	5.33	**97**	**50.95**	**11.2**	**95.98**	**6740.86**	
sct	PM	466	438	466	461.73	**6.85**	466	238.82	25.47	0.92	9181.48	7.74E-22
	SAM		**92**	**107**	**108.48**	9.34	**134**	**65.45**	**16.35**	**76.72**	**5489.81**	
tcon	PM	49	43	49	48	**1.61**	**49**	26.33	4.53	2.04	401.38	1.60E-3
	SAM		**40**	**46**	**46.3**	2.39	**49**	**26.17**	**4.37**	**5.51**	**379.67**	

Table 4: Experiment 1 - Number of transistors obtained for the first feasible solution and the final solution for all problems of group 1

Problem	Method	First Feasible Solution (FFS)					Final Solution (FS)					RR	p-value	p-value
		Best	Median	Mean	std	Worst	Best	Median	Mean	std	Worst	(%)	(FFS)	(FS)
C17	SAM	22	54	51.53	17.40	80	8	8	8.17	0.37	9	84.15	5.84E-1	9.66E-2
	SAMGAM	23	54.5	55.73	17.87	109	8	8	8.5	0.81	11	84.75		
cm42a	SAM	86	121.0	119.57	12.28	150	29	33.5	33.37	2.47	38	72.09	6.41E-1	3.57E-2
	SAMGAM	94	116.0	119.5	13.19	151	28	35.0	35.53	4.19	46	70.27		
cm82a	SAM	42	69.0	69.43	11.33	93	20	26.0	28.0	6.69	47	59.67	1.10E-1	8.65E-1
	SAMGAM	46	75.5	77.17	17.62	116	18	26.5	27.67	5.76	44	64.14		
cm138a	SAM	76	105.0	105.57	16.39	138	27	32.0	32.4	2.81	40	69.31	1.67E-1	9.29E-1
	SAMGAM	79	114.5	111.03	12.25	133	27	32.5	32.23	2.96	38	70.97		
decod	SAM	113	137.5	138.23	12.5	163	39	53.5	52.23	6.09	64	62.22	9.60E-2	2.15E-2
	SAMGAM	125	145.0	143.13	11.41	170	45	55.0	56.33	5.61	69	60.64		
f51m	SAM	93	122.0	124.0	16.41	161	74	89.5	89.67	11.33	128	27.69	7.90E-3	3.00E-4
	SAMGAM	104	138.5	135.5	15.48	165	74	98.0	101.8	14.11	130	24.87		
majority	SAM	22	38.5	44.73	17.66	87	11	12.0	12.97	2.43	23	71.0	3.48E-1	4.43E-1
	SAMGAM	23	37.5	39.33	12.31	70	11	12.0	13.07	2.22	21	66.77		
z4ml	SAM	63	85.5	88.0	14.05	122	34	45.0	46.67	8.84	76	46.97	7.79E-2	2.76E-1
	SAMGAM	57	88.0	88.63	15.33	124	35	48.0	48.77	8.47	76	44.97		

Table 5: Experiment 1 - Number of transistors obtained for the first feasible solution and the final solution for all problems of group 2

Problem	Method	First Feasible Solution (FFS)					Final Solution (FS)					RR	p-value	p-value
		Best	Median	Mean	std	Worst	Best	Median	Mean	std	Worst	(%)	(FFS)	(FS)
9symml	SAM	95	169.5	199.4	67.24	332	77	119.0	125.93	37.33	210	36.85	4.48E-1	9.82E-1
	SAMGAM	118	192.0	205.24	50.23	341	81	121.0	123.97	33.82	234	39.6		
alu2	SAM	393	416.0	416.0	23.0	439	306	327.5	327.5	21.5	349	21.27	1.21E-1	1
	SAMGAM	463	476.0	476.0	13.0	489	284	338.0	338.0	54.0	392	28.99		
alu4	SAM	222	329.0	337.79	68.02	469	158	203.5	210.14	34.9	283	37.79	1.58E-2	2.57E-2
	SAMGAM	268	391.5	396.67	81.34	549	151	238.0	246.12	59.07	357	37.95		
cm85a	SAM	70	146.5	151.73	49.32	298	42	50.0	51.23	6.81	68	66.24	7.48E-4	1.18E-1
	SAMGAM	88	208.5	200.37	53.68	301	42	53.0	54.0	7.63	79	73.05		
cm151a	SAM	78	141.0	152.73	48.79	282	36	44.0	46.2	7.75	78	69.75	6.26E-1	8.47E-1
	SAMGAM	84	158.0	156.27	43.79	294	36	45.0	44.9	5.38	57	71.27		
cm162a	SAM	110	218.5	213.57	54.32	304	54	65.0	65.87	5.62	78	69.16	9.35E-1	8.53E-1
	SAMGAM	133	219.5	218.17	52.56	382	56	65.0	65.33	5.0	74	70.06		
cu	SAM	126	241.5	241.83	54.44	383	58	67.0	66.77	4.99	79	72.39	3.10E-3	6.25E-1
	SAMGAM	192	278.0	298.17	66.71	406	59	67.0	67.33	4.18	77	77.42		
x2	SAM	152	213.0	224.43	51.92	374	51	60.5	62.23	8.94	99	72.27	2.03E-2	2.79E-1
	SAMGAM	132	247.0	253.87	53.77	352	55	62.5	62.1	3.62	68	75.54		

Table 6: Experiment 1 - Number of transistors obtained for the first feasible solution and the final solution for all problems of group 3

Problem	Method	First Feasible Solution (FFS)					Final Solution (FS)					RR	p-value	p-value
		Best	Median	Mean	std	Worst	Best	Median	Mean	std	Worst	(%)	(FFS)	(FS)
cc	SAM	360	512.5	519.57	94.49	729	74	86.5	86.57	6.44	99	83.34	8.65E-5	7.33E-3
	SAMGAM	410	643.5	636.53	103.68	863	80	89.5	91.97	7.71	116	85.55		
cmb	SAM	387	430.5	430.5	43.5	474	53	54.0	54.0	1.0	55	87.46	-	-
	SAMGAM	-	-	-	-	-	-	-	-	-	-	-		
cordic	SAM	-	-	-	-	-	-	-	-	-	-	-	-	-
	SAMGAM	-	-	-	-	-	-	-	-	-	-	-		
frg1	SAM	107	158.0	160.0	28.62	242	84	97.5	96.73	7.15	114	39.54	5.11E-1	7.00E-1
	SAMGAM	108	150.5	158.07	36.74	257	83	96.0	96.27	6.7	112	39.1		
pm1	SAM	155	275.5	271.3	59.76	415	53	58.0	57.77	2.08	62	78.71	6.34E-3	2.26E-2
	SAMGAM	199	320.0	329.93	76.21	545	53	59.0	59.45	2.87	65	81.98		
sct	SAM	275	395.0	410.17	83.38	597	83	98.0	97.35	6.68	112	76.27	1.20E-4	3.51E-2
	SAMGAM	386	513.5	516.31	81.26	758	91	101.0	101.42	5.83	113	80.36		
t481	SAM	60	145.5	162.67	72.38	413	41	55.5	63.3	24.08	144	61.09	6.26E-1	6.25E-1
	SAMGAM	62	128.5	163.87	89.64	390	42	56.5	61.27	14.92	95	62.61		
tcon	SAM	345	468.0	497.2	87.77	719	36	43.5	44.17	6.43	58	91.12	9.18E-6	6.62E-1
	SAMGAM	469	600.0	605.63	65.54	761	32	43.5	45.27	7.76	65	92.53		
vda	SAM	-	-	-	-	-	-	-	-	-	-	-	-	-
	SAMGAM	-	-	-	-	-	-	-	-	-	-	-		

Table 7: Experiment 2 - Types and Total Logic Gates and Depth for group 1

Problem	Method	Final Solution								
		AND	OR	NOT	NAND	NOR	XOR	XNOR	TOTAL	Depth
C17	PM	6	0	0	0	0	0	0	6	4
	SAM	4	0	0	0	0	0	0	4	4
cm42a	PM	0.63	8.82	2.15	4.57	5.32	0	0	21.48	6.45
	SAM	0.4	8.27	1.8	5.15	5.83	0	0	21.45	6.58
cm82a	PM	1.9	1.1	0.55	0	4.52	3.03	0.42	11.52	8.12
	SAM	1.75	1.3	0.8	0.03	6.47	2.22	0.62	13.18	8.58
cm138a	PM	0.35	11.57	3	3.07	5.5	0	0	23.48	7.97
	SAM	0.28	11.58	2.73	2.93	6.15	0.03	0	23.72	8.32
decod	PM	29.73	0.22	3.43	0.17	4.15	0.15	0	37.85	7.5
	SAM	29.28	0.18	3.13	0.42	5.7	0.02	0	38.73	7.57
f51m	PM	246	69	8	0	0	0	0	323	29
	SAM	131.77	64.35	8.5	0.13	8.42	0.62	0.6	214.38	23.4
majority	PM	4.07	3.03	0.1	0.43	1.43	0	0	9.07	6.43
	SAM	3.17	2.17	0.13	0.5	2.63	0	0	8.6	6.27
z4ml	PM	192.97	55	7	0	0	0	0	254.97	33
	SAM	22.62	13.75	3.33	0.2	8.07	1.37	0.52	49.85	15.27

Table 8: Experiment 2 - Types and Total Logic Gates and Depth for group 2

Problem	Method	Final Solution								
		AND	OR	NOT	NAND	NOR	XOR	XNOR	TOTAL	Depth
9symml	PM	430	85	9	0	0	0	0	524	92
	SAM	72.77	45.43	8.47	0.43	13.63	0.2	0.03	140.97	22.5
alu2	PM	750	140	10	0	0	0	0	900	74
	SAM	204.82	94.37	13.73	0.18	10.48	0.07	0.05	323.7	60.68
cm85a	PM	256	45	8	0	0	0	0	309	25
	SAM	17.87	9.5	3.07	0.07	8.37	0.03	0	38.9	17.65
cm151a	PM	16	4.8	1.6	1.12	7.88	0	0	31.4	12.13
	SAM	14.25	4.87	1.53	0.33	10.57	0	0	31.55	12.02
cm162a	PM	12.13	11.73	4.05	1.02	10.57	0.72	0	40.22	11.98
	SAM	11.95	11.88	4.08	0.5	11.68	0.48	0.03	40.62	12.22
cu	PM	21.5	6.17	4.2	0.73	14.23	0	0	46.83	12.73
	SAM	19.93	5.8	3.73	0.07	16.5	0.03	0	46.07	12.47
x2	PM	8.23	13.45	3.92	2.13	9.38	0.68	0.08	37.88	13.08
	SAM	8.93	13.6	3.83	1.97	10.37	0.28	0.03	39.02	12.58

Table 9: Experiment 2 - Types and Total Logic Gates and Depth for group 3

Problem	Method	Final Solution								
		AND	OR	NOT	NAND	NOR	XOR	XNOR	TOTAL	Depth
cmb	PM	11.23	10.98	3.15	2.07	6.82	0.17	0	34.42	10.45
	SAM	10.62	13.13	3.93	2.33	8.33	0.17	0	38.52	12.28
frg1	PM	673	116	27	0	0	0	0	816	116
	SAM	109	53.63	15.5	0.23	16.5	0	0	194.87	24.93
pm1	PM	876	158	16	0	0	0	0	1050	45
	SAM	16.8	14.23	14.5	1.6	3.75	0.07	0	50.95	11.2
sct	PM	163.57	59.08	15.97	0.05	0.07	0.03	0.05	238.82	25.47
	SAM	21.67	18.77	7.53	0.25	16.23	0.65	0.35	65.45	16.35
tcon	PM	13.67	7	2.07	1	2.6	0	0	26.33	4.53
	SAM	13.2	6.93	1.83	0	4.2	0	0	26.17	4.37