Supplemental Materials

ThanhVu Nguyen

ABSTRACT

This document contains all experimental data for the paper *"Parallel Shared Memory Strategies for Ant-Based Optimization Algorithms"* (GECCO 2009).

Table 1: ABOMC$_{SM}$ Solution Quality

	Graph	Opt	ABOMC Best	Solution Avg/StdDev when run on C cores				
				$C = 1$(Seq)	$C = 2$	$C = 4$	$C = 6$	$C = 8$
1	brock200_1	21	21	19.53 / 0.52	19.57 / 0.57	19.59 / 0.55	19.68 / 0.53	19.59 / 0.51
2	brock200_2	12	11	10.03 / 0.43	10.04 / 0.31	10.09 / 0.32	10.07 / 0.38	10.09 / 0.35
3	brock200_3	15	14	12.87 / 0.46	12.81 / 0.56	12.90 / 0.41	12.99 / 0.50	12.86 / 0.40
4	brock200_4	17	16	15.00 / 0.53	15.01 / 0.48	15.07 / 0.60	15.22 / 0.48	15.11 / 0.49
5	brock400_1	27	24	22.74 / 0.69	22.68 / 0.65	22.72 / 0.69	22.83 / 0.63	22.83 / 0.63
6	brock400_2	29	25	22.69 / 0.72	22.84 / 0.61	22.83 / 0.62	22.85 / 0.65	22.79 / 0.67
7	brock400_3	31	25	22.59 / 0.65	22.65 / 0.59	22.64 / 0.70	22.72 / 0.71	22.81 / 0.64
8	brock400_4	33	25	22.87 / 0.61	22.94 / 0.65	22.86 / 0.62	22.91 / 0.62	23.06 / 0.61
9	brock800_1	23	20	18.52 / 0.64	18.55 / 0.61	18.64 / 0.59	18.59 / 0.57	18.67 / 0.63
10	brock800_2	24	21	18.50 / 0.64	18.68 / 0.53	18.64 / 0.59	18.74 / 0.61	18.80 / 0.53
11	brock800_3	25	20	18.49 / 0.54	18.51 / 0.56	18.61 / 0.63	18.69 / 0.58	18.74 / 0.58
12	brock800_4	26	21	18.31 / 0.59	18.37 / 0.56	18.56 / 0.62	18.59 / 0.62	18.50 / 0.57
13	c-fat200-1	12	12	12.00 / 0.00	12.00 / 0.00	12.00 / 0.00	12.00 / 0.00	12.00 / 0.00
14	c-fat200-2	24	24	24.00 / 0.00	24.00 / 0.00	24.00 / 0.00	24.00 / 0.00	24.00 / 0.00
15	c-fat200-5	58	58	58.00 / 0.00	58.00 / 0.00	58.00 / 0.00	58.00 / 0.00	58.00 / 0.00
16	c-fat500-1	14	14	14.00 / 0.00	14.00 / 0.00	14.00 / 0.00	14.00 / 0.00	14.00 / 0.00
17	c-fat500-2	26	26	26.00 / 0.00	26.00 / 0.00	26.00 / 0.00	26.00 / 0.00	26.00 / 0.00
18	c-fat500-5	64	64	64.00 / 0.00	64.00 / 0.00	64.00 / 0.00	64.00 / 0.00	64.00 / 0.00
19	c-fat500-10	126	126	126.00 / 0.00	126.00 / 0.00	126.00 / 0.00	126.00 / 0.00	126.00 / 0.00
20	c125.9	$\geq$ 34	34	33.40 / 0.81	33.35 / 0.82	33.32 / 0.79	33.46 / 0.65	33.61 / 0.53
21	c250.9	$\geq$ 44	44	41.15 / 0.95	41.14 / 0.97	41.23 / 1.04	41.02 / 1.01	41.26 / 0.94
22	c500.9	$\geq$ 57	55	51.04 / 0.96	51.24 / 1.10	51.34 / 1.16	51.26 / 1.06	51.30 / 1.07
23	c1000.9	$\geq$ 68	63	58.98 / 1.22	59.30 / 1.13	59.43 / 1.12	59.50 / 1.29	59.57 / 1.10
24	c2000.5	$\geq$ 16	16	13.99 / 0.50	14.06 / 0.40	14.16 / 0.46	14.13 / 0.50	14.17 / 0.47
25	c2000.9	$\geq$ 77	70	66.08 / 1.09	66.50 / 1.12	66.73 / 1.09	66.75 / 1.06	66.57 / 1.06
26	c4000.5	$\geq$ 18	17	14.95 / 0.50	15.22 / 0.46	15.09 / 0.43	15.30 / 0.52	15.22 / 0.44
27	dsjc500.5	$\geq$ 13	13	11.95 / 0.43	12.04 / 0.40	12.01 / 0.48	12.00 / 0.42	12.16 / 0.46
28	dsjc1000.5	$\geq$ 15	15	13.00 / 0.45	13.12 / 0.55	13.14 / 0.42	13.04 / 0.42	13.12 / 0.45
29	gen200_p0.9_44	44	40	37.23 / 1.04	37.21 / 0.90	37.47 / 0.83	37.46 / 1.02	37.22 / 0.78
30	gen200_p0.9_55	55	55	42.35 / 5.31	41.45 / 4.56	41.89 / 4.83	42.06 / 5.02	41.51 / 4.55
31	gen400_p0.9_55	55	51	48.33 / 0.91	48.64 / 1.04	48.59 / 0.97	48.35 / 0.99	48.45 / 0.97
32	gen400_p0.9_65	65	65	47.86 / 3.52	47.37 / 2.16	47.91 / 3.28	48.46 / 4.12	47.78 / 2.93
33	gen400_p0.9_75	75	75	51.69 / 7.22	54.27 / 9.55	51.85 / 7.34	52.73 / 8.68	51.38 / 6.89
34	hamming6-2	32	32	32.00 / 0.00	32.00 / 0.00	32.00 / 0.00	32.00 / 0.00	32.00 / 0.00
35	hamming6-4	4	4	4.00 / 0.00	4.00 / 0.00	4.00 / 0.00	4.00 / 0.00	4.00 / 0.00
36	hamming8-2	128	128	128.00 / 0.00	128.00 / 0.00	128.00 / 0.00	128.00 / 0.00	128.00 / 0.00
37	hamming8-4	16	16	16.00 / 0.00	16.00 / 0.00	16.00 / 0.00	16.00 / 0.00	16.00 / 0.00
38	hamming10-2	512	512	512.00 / 0.00	512.00 / 0.00	512.00 / 0.00	512.00 / 0.00	512.00 / 0.00
39	hamming10-4	40	40	34.92 / 0.91	35.00 / 0.95	35.34 / 1.12	35.48 / 0.87	35.50 / 1.10
40	johnson8-2-4	4	4	4.00 / 0.00	4.00 / 0.00	4.00 / 0.00	4.00 / 0.00	4.00 / 0.00
41	johnson8-4-4	14	14	14.00 / 0.00	14.00 / 0.00	14.00 / 0.00	14.00 / 0.00	14.00 / 0.00
42	johnson16-2-4	8	8	8.00 / 0.00	8.00 / 0.00	8.00 / 0.00	8.00 / 0.00	8.00 / 0.00
43	johnson32-2-4	16	16	16.00 / 0.00	16.00 / 0.00	16.00 / 0.00	16.00 / 0.00	16.00 / 0.00
44	keller4	11	11	10.04 / 0.89	10.06 / 0.88	10.36 / 0.78	10.14 / 0.85	10.20 / 0.82
45	keller5	27	25	21.43 / 0.83	21.55 / 0.94	21.67 / 0.92	21.64 / 0.97	21.69 / 0.99
46	keller6	$\geq$ 59	48	43.27 / 1.45	43.19 / 1.47	43.74 / 1.30	43.71 / 1.34	43.57 / 1.31
47	mann_a9	16	16	16.00 / 0.00	16.00 / 0.00	16.00 / 0.00	16.00 / 0.00	16.00 / 0.00
48	mann_a27	126	125	125.00 / 0.00	125.00 / 0.00	125.00 / 0.00	125.00 / 0.00	125.00 / 0.00
49	mann_a45	345	342	342.00 / 0.00	342.00 / 0.00	342.00 / 0.00	342.00 / 0.00	342.00 / 0.00
50	mann_a81	$\geq$ 1100	1096	1096.00 / 0.00	1096.00 / 0.00	1096.00 / 0.00	1096.00 / 0.00	1096.00 / 0.00
51	p_hat300-1	8	8	7.96 / 0.20	7.97 / 0.17	7.95 / 0.22	7.93 / 0.26	7.96 / 0.20
52	p_hat300-2	25	25	25.00 / 0.00	25.00 / 0.00	25.00 / 0.00	25.00 / 0.00	25.00 / 0.00
53	p_hat300-3	36	36	35.12 / 0.83	35.24 / 0.85	35.23 / 0.82	35.11 / 0.85	35.13 / 0.86
54	p_hat500-1	9	9	8.97 / 0.17	9.00 / 0.00	9.00 / 0.00	8.99 / 0.10	9.00 / 0.00
55	p_hat500-2	36	36	35.92 / 0.27	35.95 / 0.22	35.98 / 0.14	35.92 / 0.27	35.91 / 0.29
56	p_hat500-3	$\geq$ 50	50	49.03 / 0.52	48.93 / 0.53	49.00 / 0.62	49.05 / 0.54	49.06 / 0.47
57	p_hat700-1	11	11	9.25 / 0.54	9.27 / 0.58	9.21 / 0.52	9.25 / 0.55	9.25 / 0.55
58	p_hat700-2	$\geq$ 44	44	43.62 / 0.49	43.57 / 0.50	43.69 / 0.46	43.64 / 0.48	43.63 / 0.48
59	p_hat700-3	$\geq$ 62	62	61.20 / 0.49	61.33 / 0.55	61.36 / 0.50	61.45 / 0.50	61.26 / 0.46
60	p_hat1000-1	$\geq$ 10	10	9.95 / 0.22	9.95 / 0.22	10.00 / 0.00	9.97 / 0.17	9.96 / 0.20
61	p_hat1000-2	$\geq$ 46	46	45.21 / 0.50	45.25 / 0.52	45.38 / 0.49	45.33 / 0.53	45.43 / 0.51
62	p_hat1000-3	$\geq$ 68	66	64.13 / 0.64	64.08 / 0.66	64.22 / 0.61	64.14 / 0.57	64.22 / 0.70
63	p_hat1500-1	$\geq$ 12	11	10.80 / 0.40	10.84 / 0.37	10.80 / 0.40	10.86 / 0.35	10.83 / 0.38
64	p_hat1500-2	$\geq$ 65	65	63.63 / 0.61	63.54 / 0.62	63.69 / 0.56	63.66 / 0.53	63.76 / 0.62
65	p_hat1500-3	$\geq$ 94	94	91.55 / 0.94	91.67 / 0.97	91.74 / 0.80	91.81 / 0.72	91.94 / 0.80
66	san200_0.7_1	30	30	21.40 / 5.95	20.58 / 5.65	21.43 / 6.04	20.24 / 5.40	21.32 / 5.93
67	san200_0.7_2	18	15	13.07 / 0.51	13.02 / 0.49	13.05 / 0.46	13.16 / 0.50	13.11 / 0.58
68	san200_0.9_1	70	51	45.40 / 0.58	45.21 / 0.43	45.25 / 0.70	45.26 / 0.48	45.20 / 0.40
69	san200_0.9_2	60	60	39.58 / 2.08	39.44 / 2.46	39.28 / 1.51	39.49 / 2.39	39.75 / 2.64
70	san200_0.9_3	44	43	34.80 / 1.10	34.82 / 0.98	34.88 / 1.12	35.00 / 0.85	34.74 / 0.82
71	san400_0.5_1	13	13	8.70 / 0.78	8.75 / 0.67	8.75 / 0.62	8.76 / 0.88	8.80 / 0.88
72	san400_0.7_1	40	40	24.75 / 6.30	25.30 / 6.74	24.81 / 6.39	24.08 / 5.49	25.70 / 7.02
73	san400_0.7_2	30	30	18.44 / 2.29	18.27 / 1.80	18.49 / 2.17	18.29 / 1.76	18.31 / 1.75
74	san400_0.7_3	22	18	15.83 / 0.53	15.83 / 0.45	15.90 / 0.52	15.96 / 0.45	15.94 / 0.34
75	san400_0.9_1	100	100	72.84 / 21.68	73.53 / 21.64	74.67 / 21.97	72.38 / 21.59	70.12 / 21.09
76	san1000	15	15	10.02 / 0.53	9.97 / 0.17	9.96 / 0.20	9.96 / 0.20	10.09 / 0.72
77	sanr200_0.7	18	18	17.48 / 0.54	17.31 / 0.61	17.41 / 0.53	17.33 / 0.58	17.27 / 0.56
78	sanr200_0.9	42	41	40.18 / 0.75	40.25 / 0.85	40.10 / 0.79	40.20 / 0.77	40.13 / 0.89
79	sanr400_0.5	13	13	12.04 / 0.34	12.02 / 0.32	12.18 / 0.43	12.07 / 0.43	12.12 / 0.35
80	sanr400_0.7	21	21	19.32 / 0.65	19.44 / 0.61	19.38 / 0.54	19.42 / 0.55	19.42 / 0.55

Table 2: ABOMC$_{\mathrm{SM}}$ results (continue)

	Graph	Opt	ABOMC Best	Solution Avg/StdDev when run on C cores				
				C_1(Seq)	C_2	C_4	C_6	C_8
81	frb30-15-1	30	28	25.46 / 0.64	25.49 / 0.69	25.45 / 0.65	25.56 / 0.71	25.51 / 0.61
82	frb30-15-2	30	28	25.55 / 0.65	25.57 / 0.67	25.58 / 0.62	25.65 / 0.73	25.66 / 0.62
83	frb30-15-3	30	28	25.39 / 0.71	25.36 / 0.67	25.58 / 0.59	25.42 / 0.57	25.43 / 0.65
84	frb30-15-4	30	28	25.53 / 0.71	25.66 / 0.67	25.80 / 0.66	25.79 / 0.67	25.83 / 0.69
85	frb30-15-5	30	28	25.76 / 0.78	25.71 / 0.55	25.81 / 0.63	25.91 / 0.58	25.92 / 0.56
86	frb35-17-1	35	32	29.24 / 0.68	29.27 / 0.60	29.34 / 0.59	29.33 / 0.69	29.41 / 0.66
87	frb35-17-2	35	32	29.43 / 0.76	29.51 / 0.75	29.58 / 0.75	29.51 / 0.74	29.63 / 0.74
88	frb35-17-3	35	32	29.90 / 0.61	30.04 / 0.60	30.28 / 0.74	30.18 / 0.71	30.12 / 0.78
89	frb35-17-4	35	32	29.48 / 0.67	29.41 / 0.69	29.52 / 0.66	29.60 / 0.63	29.53 / 0.61
90	frb35-17-5	35	32	29.47 / 0.71	29.48 / 0.71	29.57 / 0.70	29.59 / 0.72	29.67 / 0.66
91	frb40-19-1	40	35	32.99 / 0.84	32.96 / 0.69	33.02 / 0.69	32.98 / 0.69	33.14 / 0.77
92	frb40-19-2	40	36	33.40 / 0.62	33.44 / 0.65	33.51 / 0.71	33.58 / 0.64	33.74 / 0.70
93	frb40-19-3	40	36	33.45 / 0.71	33.60 / 0.73	33.63 / 0.72	33.58 / 0.75	33.57 / 0.75
94	frb40-19-4	40	36	33.96 / 0.80	34.07 / 0.80	34.06 / 0.69	34.03 / 0.62	34.20 / 0.80
95	frb40-19-5	40	36	33.80 / 0.72	33.77 / 0.71	33.83 / 0.68	33.88 / 0.65	34.02 / 0.79
96	frb45-21-1	45	40	36.74 / 0.81	36.80 / 0.87	36.91 / 0.71	36.79 / 0.75	36.86 / 0.86
97	frb45-21-2	45	40	37.14 / 0.74	37.24 / 0.80	37.30 / 0.70	37.43 / 0.82	37.45 / 0.75
98	frb45-21-3	45	40	36.75 / 0.68	36.85 / 0.86	36.98 / 0.73	36.94 / 0.69	37.20 / 0.73
99	frb45-21-4	45	40	37.21 / 0.83	37.23 / 0.75	37.46 / 0.68	37.51 / 0.81	37.29 / 0.70
100	frb45-21-5	45	40	36.85 / 0.82	36.92 / 0.67	37.08 / 0.90	37.26 / 0.80	37.12 / 0.70
101	frb50-23-1	50	44	40.85 / 0.77	40.73 / 0.79	40.94 / 0.79	40.91 / 0.80	40.90 / 0.78
102	frb50-23-2	50	44	40.87 / 0.81	40.96 / 0.79	41.20 / 0.73	41.21 / 0.86	41.36 / 0.83
103	frb50-23-3	50	44	41.35 / 0.80	41.54 / 0.88	41.59 / 0.84	41.69 / 0.76	41.60 / 0.85
104	frb50-23-4	50	44	40.78 / 0.78	40.84 / 0.80	40.96 / 0.82	40.99 / 0.73	40.94 / 0.68
105	frb50-23-5	50	43	40.62 / 0.92	40.79 / 0.77	40.91 / 0.76	41.03 / 0.74	40.96 / 0.73
106	frb53-24-1	53	45	42.29 / 0.74	42.44 / 0.83	42.64 / 0.89	42.47 / 0.75	42.58 / 0.95
107	frb53-24-2	53	46	43.23 / 0.88	43.12 / 0.67	43.29 / 0.79	43.46 / 0.79	43.46 / 0.82
108	frb53-24-3	53	46	43.10 / 0.83	43.30 / 0.79	43.25 / 0.79	43.46 / 0.90	43.49 / 0.84
109	frb53-24-4	53	46	42.61 / 0.79	42.98 / 0.80	42.96 / 0.76	43.12 / 0.95	43.11 / 0.76
110	frb53-24-5	53	46	42.92 / 0.81	43.01 / 0.79	43.32 / 0.72	43.30 / 0.82	43.30 / 0.77
111	frb56-25-1	56	48	44.76 / 0.94	44.87 / 0.86	45.13 / 0.88	45.05 / 0.90	44.98 / 0.77
112	frb56-25-2	56	49	45.02 / 0.75	45.17 / 0.74	45.31 / 0.78	45.55 / 0.84	45.30 / 0.74
113	frb56-25-3	56	48	45.47 / 0.83	45.55 / 0.86	45.69 / 0.89	45.85 / 0.80	45.73 / 0.77
114	frb56-25-4	56	48	45.35 / 0.84	45.52 / 0.78	45.53 / 0.87	45.73 / 0.77	45.73 / 0.91
115	frb56-25-5	56	48	45.46 / 0.94	45.51 / 0.88	45.62 / 0.76	45.67 / 0.75	45.59 / 0.74
116	frb59-26-1	59	51	47.59 / 0.91	47.76 / 0.78	47.89 / 0.81	47.85 / 0.82	47.99 / 0.88
117	frb59-26-2	59	50	47.55 / 0.91	47.77 / 0.85	47.92 / 0.76	47.96 / 0.75	48.01 / 0.71
118	frb59-26-3	59	51	47.12 / 0.97	47.26 / 0.77	47.41 / 0.87	47.24 / 0.69	47.33 / 0.90
119	frb59-26-4	59	50	47.39 / 0.79	47.70 / 0.94	47.66 / 0.78	47.94 / 0.81	47.85 / 0.78
120	frb59-26-5	59	50	47.33 / 0.85	47.63 / 0.84	47.63 / 0.97	47.80 / 0.80	47.77 / 0.81
121	frb100-40	100	81	77.26 / 1.01	77.36 / 1.03	77.55 / 0.96	77.50 / 1.00	77.54 / 1.04

Table 3: ABOMC$_{SM}$ Average Running Time and Improvement Factor in Running Time

			Running Time†: T_{avg}/S_p when run on C cores				
	Graph	Vertices/Edges	$C = 1$(Seq)	$C = 2$	$C = 4$	$C = 6$	$C = 8$
1	brock200_1	200 / 14834	2.43	1.59 / 1.53	1.03 / 2.36	0.86 / 2.83	0.77 / 3.16
2	brock200_2	200 / 9876	1.68	1.13 / 1.49	0.75 / 2.25	0.65 / 2.59	0.61 / 2.76
3	brock200_3	200 / 12048	2.00	1.32 / 1.52	0.86 / 2.32	0.73 / 2.73	0.68 / 2.96
4	brock200_4	200 / 13089	2.16	1.42 / 1.52	0.91 / 2.38	0.78 / 2.76	0.71 / 3.05
5	brock400_1	400 / 59723	9.68	6.24 / 1.55	3.83 / 2.53	2.95 / 3.28	2.47 / 3.92
6	brock400_2	400 / 59786	9.71	6.25 / 1.55	3.82 / 2.54	2.97 / 3.27	2.46 / 3.95
7	brock400_3	400 / 59681	9.69	6.25 / 1.55	3.83 / 2.53	2.98 / 3.25	2.49 / 3.89
8	brock400_4	400 / 59765	9.69	6.25 / 1.55	3.83 / 2.53	2.98 / 3.25	2.48 / 3.91
9	brock800_1	800 / 207505	47.95	27.70 / 1.73	15.99 / 3.00	11.80 / 4.06	9.64 / 4.98
10	brock800_2	800 / 208166	48.20	27.82 / 1.73	16.06 / 3.00	11.84 / 4.07	9.71 / 4.96
11	brock800_3	800 / 207333	48.04	27.72 / 1.73	15.96 / 3.01	11.80 / 4.07	9.64 / 4.99
12	brock800_4	800 / 207643	48.03	27.74 / 1.73	16.02 / 3.00	11.78 / 4.08	9.65 / 4.98
13	c-fat200-1	200 / 1534	0.40	0.34 / 1.20	0.29 / 1.40	0.32 / 1.25	0.37 / 1.09
14	c-fat200-2	200 / 3235	0.67	0.53 / 1.27	0.40 / 1.67	0.40 / 1.66	0.53 / 1.25
15	c-fat200-5	200 / 8473	1.66	1.09 / 1.52	1.01 / 1.64	0.66 / 2.52	0.61 / 2.71
16	c-fat500-1	500 / 4459	1.16	0.92 / 1.26	0.87 / 1.33	0.75 / 1.56	0.76 / 1.53
17	c-fat500-2	500 / 9139	1.84	1.32 / 1.40	0.93 / 1.98	0.86 / 2.14	0.86 / 2.13
18	c-fat500-5	500 / 23191	4.02	2.65 / 1.52	1.69 / 2.38	1.37 / 2.93	1.23 / 3.25
19	c-fat500-10	500 / 46627	8.24	5.29 / 1.56	3.26 / 2.52	2.54 / 3.25	2.24 / 3.67
20	c125.9	125 / 6963	1.32	0.86 / 1.53	0.57 / 2.29	0.51 / 2.55	0.50 / 2.62
21	c250.9	250 / 27984	4.64	2.98 / 1.56	1.86 / 2.50	1.46 / 3.17	1.25 / 3.73
22	c500.9	500 / 112332	19.80	12.53 / 1.58	7.46 / 2.65	5.63 / 3.52	4.63 / 4.28
23	c1000.9	1000 / 450079	135.20	74.08 / 1.83	41.12 / 3.29	29.98 / 4.51	24.43 / 5.54
24	c2000.5	2000 / 999836	364.07	194.44 / 1.87	105.90 / 3.44	76.90 / 4.73	62.27 / 5.85
25	c2000.9	2000 / 1799532	700.17	369.16 / 1.90	200.84 / 3.49	145.00 / 4.83	117.38 / 5.97
26	c4000.5	4000 / 4000268	1729.44	899.15 / 1.92	484.32 / 3.57	349.78 / 4.94	281.94 / 6.13
27	dsjc500.5	500 / 125248	10.35	7.25 / 1.43	4.35 / 2.38	3.33 / 3.11	2.83 / 3.66
28	dsjc1000.5	1000 / 499652	64.39	37.91 / 1.70	21.46 / 3.00	15.71 / 4.10	12.78 / 5.04
29	gen200_p0.9_44	200 / 17910	3.00	1.94 / 1.55	1.21 / 2.49	1.00 / 3.01	0.90 / 3.35
30	gen200_p0.9_55	200 / 17910	3.04	1.95 / 1.55	1.22 / 2.50	1.01 / 3.02	0.92 / 3.32
31	gen400_p0.9_55	400 / 71820	11.82	7.64 / 1.55	4.61 / 2.56	3.56 / 3.32	2.95 / 4.00
32	gen400_p0.9_65	400 / 71820	11.82	7.61 / 1.55	4.62 / 2.56	3.56 / 3.32	2.96 / 3.99
33	gen400_p0.9_75	400 / 71820	11.86	7.64 / 1.55	4.62 / 2.57	3.56 / 3.33	2.96 / 4.01
34	hamming6-2	64 / 1824	0.39	0.28 / 1.39	0.23 / 1.71	0.23 / 1.70	0.23 / 1.66
35	hamming6-4	64 / 704	0.15	0.13 / 1.15	0.14 / 1.07	0.14 / 1.08	0.14 / 1.07
36	hamming8-2	256 / 31616	6.32	3.92 / 1.61	2.38 / 2.65	1.89 / 3.34	1.57 / 4.02
37	hamming8-4	256 / 20864	3.44	2.21 / 1.55	1.38 / 2.49	1.11 / 3.10	1.02 / 3.37
38	hamming10-2	1024 / 518656	196.52	106.87 / 1.84	59.38 / 3.31	43.49 / 4.52	35.39 / 5.55
39	hamming10-4	1024 / 434176	127.18	69.47 / 1.83	38.42 / 3.31	27.97 / 4.55	22.68 / 5.61
40	johnson8-2-4	28 / 210	0.05	0.05 / 0.92	0.07 / 0.73	0.08 / 0.66	0.08 / 0.64
41	johnson8-4-4	70 / 1855	0.38	0.28 / 1.35	0.26 / 1.47	0.27 / 1.40	0.30 / 1.25
42	johnson16-2-4	120 / 5460	0.92	0.62 / 1.50	0.44 / 2.09	0.41 / 2.27	0.40 / 2.32
43	johnson32-2-4	496 / 107880	18.12	11.44 / 1.58	6.77 / 2.67	5.09 / 3.56	4.22 / 4.30
44	keller4	171 / 9435	1.61	1.08 / 1.49	0.77 / 2.10	0.70 / 2.29	0.61 / 2.65
45	keller5	776 / 225990	54.07	30.81 / 1.76	17.66 / 3.06	12.96 / 4.17	10.60 / 5.10
46	keller6	3361 / 4619898	1994.50	1035.62 / 1.93	558.68 / 3.57	402.71 / 4.95	324.74 / 6.14
47	mann_a9	45 / 918	0.21	0.15 / 1.33	0.16 / 1.29	0.15 / 1.33	0.15 / 1.33
48	mann_a27	378 / 70551	13.62	8.56 / 1.59	5.11 / 2.67	3.97 / 3.43	3.38 / 4.03
49	mann_a45	1035 / 533115	197.63	107.91 / 1.83	60.50 / 3.27	44.72 / 4.42	36.77 / 5.37
50	mann_a81	3321 / 5506380	2832.70	1493.13 / 1.90	830.36 / 3.41	611.31 / 4.63	500.22 / 5.66
51	p_hat300-1	300 / 10933	2.17	1.42 / 1.53	0.93 / 2.34	0.82 / 2.66	0.76 / 2.88
52	p_hat300-2	300 / 21928	4.03	2.56 / 1.58	1.59 / 2.54	1.27 / 3.17	1.13 / 3.58
53	p_hat300-3	300 / 33390	5.52	3.54 / 1.56	2.19 / 2.53	1.73 / 3.19	1.45 / 3.80
54	p_hat500-1	500 / 31569	6.00	3.84 / 1.56	2.38 / 2.52	1.89 / 3.16	1.64 / 3.67
55	p_hat500-2	500 / 62946	11.52	7.29 / 1.58	4.42 / 2.61	3.42 / 3.37	2.86 / 4.02
56	p_hat500-3	500 / 93800	15.97	10.26 / 1.56	6.20 / 2.57	4.76 / 3.36	4.02 / 3.98
57	p_hat700-1	700 / 60999	11.65	7.37 / 1.58	4.52 / 2.58	3.48 / 3.35	2.94 / 3.96
58	p_hat700-2	700 / 121728	25.02	15.41 / 1.62	9.14 / 2.74	6.88 / 3.64	5.58 / 4.48
59	p_hat700-3	700 / 183010	40.83	23.91 / 1.71	13.84 / 2.95	10.24 / 3.99	8.38 / 4.87
60	p_hat1000-1	1000 / 122253	26.14	16.04 / 1.63	9.43 / 2.77	7.03 / 3.72	5.76 / 4.54
61	p_hat1000-2	1000 / 244799	68.14	38.30 / 1.78	21.77 / 3.13	15.95 / 4.27	13.02 / 5.23
62	p_hat1000-3	1000 / 371746	106.87	59.01 / 1.81	33.07 / 3.23	24.09 / 4.44	19.68 / 5.43
63	p_hat1500-1	1500 / 284923	87.33	48.50 / 1.80	27.19 / 3.21	19.80 / 4.41	16.13 / 5.42
64	p_hat1500-2	1500 / 568960	203.99	109.92 / 1.86	60.60 / 3.37	43.99 / 4.64	35.72 / 5.71
65	p_hat1500-3	1500 / 847244	296.09	158.99 / 1.86	87.13 / 3.40	63.29 / 4.68	51.35 / 5.77
66	san200_0.7_1	200 / 13930	2.29	1.50 / 1.53	0.96 / 2.37	0.82 / 2.80	0.76 / 3.03
67	san200_0.7_2	200 / 13930	2.34	1.52 / 1.54	0.98 / 2.39	0.82 / 2.84	0.74 / 3.14
68	san200_0.9_1	200 / 17910	3.21	2.06 / 1.56	1.27 / 2.53	1.04 / 3.08	0.96 / 3.33
69	san200_0.9_2	200 / 17910	3.05	1.96 / 1.56	1.22 / 2.50	1.01 / 3.01	0.92 / 3.33
70	san200_0.9_3	200 / 17910	2.99	1.93 / 1.55	1.20 / 2.49	0.99 / 3.02	0.89 / 3.35
71	san400_0.5_1	400 / 39900	6.55	4.23 / 1.55	2.65 / 2.47	2.08 / 3.15	1.77 / 3.71
72	san400_0.7_1	400 / 55860	9.02	5.83 / 1.55	3.58 / 2.52	2.77 / 3.25	2.33 / 3.87
73	san400_0.7_2	400 / 55860	9.02	5.81 / 1.55	3.60 / 2.50	2.80 / 3.22	2.37 / 3.80
74	san400_0.7_3	400 / 55860	9.05	5.82 / 1.55	3.64 / 2.48	2.76 / 3.28	2.31 / 3.91
75	san400_0.9_1	400 / 71820	11.85	7.64 / 1.55	4.63 / 2.56	3.55 / 3.33	2.97 / 3.99
76	san1000	1000 / 250500	63.37	35.87 / 1.77	20.36 / 3.11	15.08 / 4.20	12.29 / 5.16
77	sanr200_0.7	200 / 13868	2.28	1.52 / 1.50	1.01 / 2.27	0.85 / 2.70	0.78 / 2.92
78	sanr200_0.9	200 / 17863	3.15	2.09 / 1.51	1.39 / 2.26	1.06 / 2.96	0.98 / 3.20
79	sanr400_0.5	400 / 39984	7.29	4.35 / 1.68	2.69 / 2.72	2.10 / 3.48	1.90 / 3.85
80	sanr400_0.7	400 / 55869	9.11	5.89 / 1.55	3.70 / 2.46	2.82 / 3.23	2.35 / 3.87

† All times are in seconds.

Table 4: ABOMC$_{SM}$ Time and Speed-up results (continue)

	Graph	Vertices/Edges	Running Time† Avg/Speed-up when run on C cores				
			C_1(Seq)	C_2	C_4	C_6	C_8
81	frb30-15-1	450 / 83198	13.65	8.82 / 1.55	5.33 / 2.56	4.09 / 3.34	3.42 / 3.99
82	frb30-15-2	450 / 83151	13.59	8.82 / 1.54	5.33 / 2.55	4.07 / 3.34	3.43 / 3.96
83	frb30-15-3	450 / 83216	13.62	8.86 / 1.54	5.37 / 2.53	4.09 / 3.33	3.40 / 4.00
84	frb30-15-4	450 / 83194	13.63	8.83 / 1.54	5.34 / 2.55	4.07 / 3.34	3.42 / 3.98
85	frb30-15-5	450 / 83231	13.62	8.83 / 1.54	5.34 / 2.55	4.11 / 3.31	3.41 / 3.99
86	frb35-17-1	595 / 148859	29.95	18.12 / 1.65	10.64 / 2.81	7.89 / 3.80	6.44 / 4.65
87	frb35-17-2	595 / 148868	29.87	18.08 / 1.65	10.60 / 2.82	7.88 / 3.79	6.43 / 4.65
88	frb35-17-3	595 / 148784	29.72	18.02 / 1.65	10.51 / 2.83	7.92 / 3.75	6.52 / 4.55
89	frb35-17-4	595 / 148873	30.27	18.10 / 1.67	10.67 / 2.84	7.89 / 3.84	6.42 / 4.72
90	frb35-17-5	595 / 148572	29.80	18.03 / 1.65	10.56 / 2.82	7.95 / 3.75	6.60 / 4.52
91	frb40-19-1	760 / 247106	61.49	34.83 / 1.77	19.84 / 3.10	14.57 / 4.22	11.90 / 5.17
92	frb40-19-2	760 / 247157	61.37	34.86 / 1.76	19.84 / 3.09	14.53 / 4.22	11.88 / 5.17
93	frb40-19-3	760 / 247325	61.13	34.66 / 1.76	19.68 / 3.11	14.46 / 4.23	11.83 / 5.17
94	frb40-19-4	760 / 246815	60.99	34.58 / 1.76	19.68 / 3.10	14.45 / 4.22	11.81 / 5.16
95	frb40-19-5	760 / 246801	61.48	34.90 / 1.76	19.86 / 3.09	14.53 / 4.23	11.89 / 5.17
96	frb45-21-1	945 / 386854	111.20	61.41 / 1.81	34.33 / 3.24	25.01 / 4.45	20.39 / 5.45
97	frb45-21-2	945 / 387416	111.33	61.43 / 1.81	34.29 / 3.25	25.02 / 4.45	20.40 / 5.46
98	frb45-21-3	945 / 387795	111.40	61.49 / 1.81	34.34 / 3.24	25.05 / 4.45	20.91 / 5.33
99	frb45-21-4	945 / 387491	111.16	61.27 / 1.81	34.27 / 3.24	24.94 / 4.46	20.33 / 5.47
100	frb45-21-5	945 / 387461	111.31	61.46 / 1.81	34.32 / 3.24	25.09 / 4.44	20.47 / 5.44
101	frb50-23-1	1150 / 580603	186.11	101.00 / 1.84	55.77 / 3.34	40.43 / 4.60	32.82 / 5.67
102	frb50-23-2	1150 / 579824	188.35	101.90 / 1.85	56.25 / 3.35	40.76 / 4.62	33.12 / 5.69
103	frb50-23-3	1150 / 579607	187.22	101.56 / 1.84	56.05 / 3.34	40.64 / 4.61	33.03 / 5.67
104	frb50-23-4	1150 / 580417	187.10	101.39 / 1.85	55.93 / 3.35	40.63 / 4.60	33.06 / 5.66
105	frb50-23-5	1150 / 580640	187.31	101.59 / 1.84	56.07 / 3.34	40.67 / 4.61	33.14 / 5.65
106	frb53-24-1	1272 / 714129	238.10	128.44 / 1.85	70.71 / 3.37	51.32 / 4.64	41.68 / 5.71
107	frb53-24-2	1272 / 714067	238.29	128.56 / 1.85	70.70 / 3.37	51.36 / 4.64	41.70 / 5.71
108	frb53-24-3	1272 / 714229	238.21	128.60 / 1.85	70.68 / 3.37	51.35 / 4.64	41.71 / 5.71
109	frb53-24-4	1272 / 714048	237.65	128.24 / 1.85	70.50 / 3.37	51.24 / 4.64	41.59 / 5.71
110	frb53-24-5	1272 / 714130	237.56	128.17 / 1.85	70.54 / 3.37	51.17 / 4.64	41.59 / 5.71
111	frb56-25-1	1400 / 869624	300.36	161.14 / 1.86	88.38 / 3.40	64.09 / 4.69	52.05 / 5.77
112	frb56-25-2	1400 / 869899	300.82	161.21 / 1.87	88.55 / 3.40	64.09 / 4.69	52.03 / 5.78
113	frb56-25-3	1400 / 869921	301.11	161.65 / 1.86	88.55 / 3.40	64.24 / 4.69	52.15 / 5.77
114	frb56-25-4	1400 / 869262	301.21	161.50 / 1.87	88.51 / 3.40	64.24 / 4.69	52.11 / 5.78
115	frb56-25-5	1400 / 869699	301.79	161.89 / 1.86	88.81 / 3.40	64.35 / 4.69	52.26 / 5.77
116	frb59-26-1	1534 / 1049256	375.98	200.80 / 1.87	109.76 / 3.43	79.47 / 4.73	64.49 / 5.83
117	frb59-26-2	1534 / 1049648	375.40	200.43 / 1.87	109.53 / 3.43	79.38 / 4.73	64.37 / 5.83
118	frb59-26-3	1534 / 1049729	374.97	200.33 / 1.87	109.51 / 3.42	79.33 / 4.73	64.35 / 5.83
119	frb59-26-4	1534 / 1048800	375.44	200.47 / 1.87	109.56 / 3.43	79.39 / 4.73	64.41 / 5.83
120	frb59-26-5	1534 / 1049829	376.29	200.93 / 1.87	109.76 / 3.43	79.56 / 4.73	64.54 / 5.83
121	frb100-40	4000 / 7425226	3279.12	1698.25 / 1.93	918.15 / 3.57	660.77 / 4.96	533.35 / 6.15

† All times are in seconds.