

vertices	edges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	184	123	61	0	114	102	113	112.8	112.8	115.7	115.3	115
100	210	153	57	0	117	107	116.6	116.2	116.1	115.6	115.5	116.6
100	189	120	69	0	124	116	123.7	123.9	123	124.2	123	123.9
100	212	158	54	0	116	105	115.8	115	115.1	114.6	114.8	116
100	195	147	48	0	142	142	142	142	142	142.1	142.3	142.7
100	234	153	81	0	124	110	123.2	123.1	121.4	120	120.9	119.6
100	188	136	52	0	128	126	128	127.9	128	128.2	128.8	128.8
99	173	125	48	0	118	109	119.8	119.5	118.1	117.8	115.9	117.1
100	224	147	77	0	117	103	116.6	115.8	114.6	114.2	113.6	113.5
100	229	172	57	0	122	104	119.8	119.1	117.2	116.8	116.5	116.3
100	199	146	53	0	118	113	117.7	117.7	117.4	117.7	118.2	118.3
100	185	140	45	0	123	115	122.8	122.3	120.9	119.7	119.3	119.3
100	198	152	46	0	116	104	117.6	117.4	116	116	115.2	116.5
100	177	120	57	0	124	120	123.8	123.9	123.6	124.3	123.8	123.8
100	239	174	65	0	118	100	117.2	117.5	114.8	113.5	112.6	112.8
100	181	128	53	0	139	139	138.9	138.9	139	139.1	139.1	138.9
100	174	128	46	0	121	118	120.8	120.7	120.8	120.8	120.2	121.2
100	206	152	54	0	122	105	121.7	120.9	119.7	118.3	116.6	116.5
100	211	155	56	0	140	138	140	140	140.3	141.9	142.7	143.5
100	191	140	51	0	136	136	136	136.1	136.2	136.6	138.9	139
100	184	128	56	0	119	111	118.8	118.8	118.3	118.6	119.1	119.6
100	240	177	63	0	132	127	131.6	131.4	130.1	128.9	129.8	128.9
99	216	148	68	0	117	100	116	115.1	113.5	112.7	113.2	113.2
100	186	141	45	0	119	111	120.8	120.8	119.6	119.7	118.7	118.8
100	207	140	67	0	114	106	113.4	113.2	112.5	113.2	113.4	113.1

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	181	120	61	0	145	145	145	145	145.1	145.2	146	146.3
100	204	141	63	0	126	120	126	125.8	125.3	125.7	126.1	126.9
100	182	142	40	0	142	142	142	142	142	142.1	142.6	142.7
100	183	135	48	0	113	110	112.9	113.1	112.9	112.7	112.9	113.4
100	210	144	66	0	117	100	117.5	117.1	114.8	113.2	112.9	112.2
100	204	146	58	0	140	140	140	140	140.1	141.1	144.6	144.9
100	257	188	69	0	129	122	128.8	128.8	128.5	128.1	128.6	128.4
100	219	157	62	0	120	113	119.8	119.2	118.5	118.3	118.1	119
100	192	144	48	0	133	131	133.8	133.6	133.2	133.1	133.3	133.3
100	195	131	64	0	117	108	116.8	116.8	117.2	117.9	118.7	118.2
100	174	124	50	0	111	101	111.8	111.7	110.9	111.1	111.8	111.3
100	233	178	55	0	136	132	136	135.8	136.5	137.6	138.7	138.6
100	187	128	59	0	124	117	123.9	123.8	123.5	123.4	123.4	124.5
100	183	127	56	0	117	116	116.9	117	117.4	117.8	118.7	118.5
100	230	161	69	0	114	100	113.8	113.8	112.4	112.5	111.8	111.9
100	231	169	62	0	148	144	147.8	147.8	147.3	148.3	147.9	148.6
100	184	135	49	0	114	105	113.8	113.9	112.5	112.5	114	113.6
100	229	156	73	0	128	124	127.9	127.9	128	127.7	130.4	130.6
100	205	140	65	0	121	106	119.8	119.3	118.9	117.8	116.3	116.1
100	202	142	60	0	117	110	116.5	116.3	115.4	115.9	116.4	116.1
100	186	131	55	0	119	116	118.9	118.8	118.8	118.9	119.6	119.3
100	216	159	57	0	122	121	122	122	122.1	122.8	124.2	124.5
100	221	158	63	0	137	129	136.8	135.8	134.5	134.5	134.8	134
100	198	139	59	0	115	99	115.4	114.6	112.7	111.7	111.7	111.3

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	224	170	54	0	116	107	115.9	115.4	114.3	115.1	115.4	115.8
100	232	169	63	0	117	101	116.7	116.1	113.7	113.2	112.1	111.8
100	201	144	57	0	119	113	117.7	117.9	118.4	121.1	120.8	120.9
100	200	148	52	0	115	103	115.7	115.3	114.7	114.1	113.2	111.7
100	215	153	62	0	142	140	142	141.9	141.8	141.6	142.6	142.6
100	172	132	40	0	114	108	112.8	112.7	113.2	112.7	112.9	112.7
100	194	133	61	0	124	118	123.5	123.3	122.6	121.8	122.3	122.5
100	206	158	48	0	114	106	114.5	114.4	112.5	112.6	113	112.8
100	217	150	67	0	129	122	129.7	129.4	127.9	127.5	128	128.1
100	194	140	54	0	136	132	134.9	134.8	135.6	136.1	137	137.3
100	189	130	59	0	119	109	118.7	118.4	116.6	115.9	115.3	115.3
100	198	149	49	0	152	152	152	152	152.1	152.1	153	153.3
100	199	144	55	0	131	127	130	130	130.3	130.6	131.6	131.8
100	220	160	60	0	127	119	127.8	127.8	126.8	126.4	126.8	126.7
99	214	156	58	0	120	115	121.9	121.7	121.7	122.1	122.4	122.6
100	206	152	54	0	122	105	121.7	121.1	119.8	117.5	117.3	116.9
100	246	186	60	0	120	102	121.1	121.1	118.2	117.1	115.8	115.6
100	219	152	67	0	117	109	117.8	117.3	116.3	116.4	116	115.7
100	205	133	72	0	125	113	124.8	124	122.1	120.6	118.8	119.2
100	233	167	66	0	117	103	115.5	115.3	114.4	113.5	114	113.7
100	210	143	67	0	119	109	118.2	118.5	117.5	117.1	116.4	117.2
100	195	148	47	0	134	134	134	134	134.2	134.2	136.4	137.1
99	202	143	59	0	116	108	115.7	115.4	115.9	116.6	116.9	116.9
100	207	145	62	0	114	105	113.7	113.8	113.2	115.3	114.6	115.1

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊢	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	210	153	57	0	117	107	116.8	116.7	116.3	116.1	115.5	116.3
100	179	123	56	0	117	113	117.1	116.8	116	116.8	116.8	116.8
100	212	148	64	0	129	126	129.7	128.8	127.2	126.7	125.8	125.7
100	204	147	57	0	119	108	120.7	120.7	119.3	118.7	118.7	118.5
100	213	154	59	0	144	143	144	143.9	144.3	145	146.1	146.7
100	228	170	58	0	119	106	118.7	118.6	117	117.9	118.3	117.9
100	214	163	51	0	144	144	143.9	143.9	143.7	143.2	143.3	143.3
100	212	148	64	0	117	103	116.6	116.4	113.9	113.8	113.3	113.1
100	257	191	66	0	122	104	121.8	120.9	118.5	118.7	116.9	116.8
100	194	143	51	0	113	104	114.8	114.6	113.3	113.8	113.1	113.1
100	233	165	68	0	127	120	127.1	126.7	126.7	127.1	128.3	128.8
100	192	138	54	0	116	110	117.6	117	115.3	114.2	113.7	114.2
100	191	137	54	0	145	145	144.9	144.8	144.8	145.4	145.3	144.8
100	199	151	48	0	132	129	132.1	131.9	131.7	131.7	132.1	132.7
100	211	152	59	0	119	112	118.8	118.8	118.8	118.8	120	120
100	220	158	62	0	118	107	116.8	116.7	115.9	115	116.8	117.4
100	188	139	49	0	113	107	111.7	111.5	112	112.2	112.7	112.1
100	180	127	53	0	117	111	116.4	116.4	115.6	115.3	115	115.9
100	224	147	77	0	117	103	116.8	116.3	115	113.3	113.5	113.3
100	167	113	54	0	122	117	121.9	121.9	122.2	122.9	122.3	122.9
100	245	177	68	0	116	101	117.4	117.6	115.2	114.5	113.4	113.8
100	217	157	60	0	126	114	125.8	125	123.5	123.4	121.7	122.6
100	233	163	70	0	122	110	121.8	121.4	119.8	119.3	120.3	119.1
100	226	159	67	0	122	102	120.5	119.8	117.5	115.6	114.7	114.2

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	217	148	69	0	117	101	118.6	118.3	116.5	115	113.3	112.8
100	194	140	54	0	136	132	135	135.1	135.5	136.6	136.9	137
100	229	163	66	0	142	141	141.9	141.9	140.4	140.9	140.6	141.6
100	208	145	63	2	131	125	130.6	130.7	130	129.1	129.5	129.6
100	216	151	65	8	141	136	140.8	140.7	140.7	140.8	140.7	140.3
100	204	143	61	7	129	122	128.5	128.5	128.4	129.3	130.1	130.4
100	219	152	67	6	126	116	125.7	125.4	124.2	124.4	124.4	124.2
100	191	140	51	3	137	137	137	137.1	137.6	138.2	140.2	139.8
100	230	155	75	3	122	118	121.9	121.7	121.7	121.7	122.4	123
99	197	141	56	4	117	107	118.9	118.2	119.4	119.6	119	118.6
100	216	158	58	4	164	164	164	163.9	164.3	165	164.9	164.8
100	174	130	44	4	129	129	129.1	129.1	130.1	130.5	131.5	131.7
100	194	133	61	6	124	119	123.7	123.7	122.5	122.1	123.3	123.2
100	195	145	50	3	122	115	121.6	121.1	117.9	117.1	116.3	117.1
100	183	129	54	4	117	110	117.1	116.9	117.8	118.5	119	119.8
100	226	158	68	8	120	103	117.8	117.4	116.4	115.8	116.3	115.5
100	175	120	55	4	121	117	120.9	120.7	121.2	121.9	122.5	123.2
100	256	170	86	1	118	105	116.8	116.6	116.3	116.6	115.5	115.5
100	204	143	61	1	142	141	142	142	142.3	142.4	144	144.2
100	218	157	61	3	118	104	120.3	119.5	115.2	113.6	114.5	113.9
100	211	148	63	4	121	113	121.7	121.8	121.2	121.6	121.7	121.5
100	206	136	70	4	125	112	124.6	123.9	122.1	121.3	119.5	119.4
99	213	154	59	9	119	106	119.4	118.4	115.7	114.1	113.1	113.8
100	177	118	59	7	118	115	117.8	117.4	117.9	117.4	117.9	117.6

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	203	145	58	7	118	109	118	117.7	116.7	117.6	117.1	117.5
100	234	174	60	7	138	137	137.9	137.8	137.6	137.3	137.9	139
99	186	135	51	4	131	131	130.9	130.9	130.9	131.3	132.1	132.5
100	177	125	52	3	115	104	114.6	114.4	113.9	114.1	114.4	113.6
100	184	122	62	3	113	100	111.8	111.8	112.2	112.8	111.7	111.9
100	173	113	60	3	119	117	118.8	118.7	118.6	118.9	119.1	119.5
100	184	143	41	6	117	113	116.8	116.7	116.8	117.3	118.3	117.8
100	195	137	58	3	119	107	118.7	118.7	117.8	117.7	117.5	116.9
100	212	132	80	4	122	112	122.8	122.6	121.6	121.2	122	122.1
100	197	140	57	2	112	104	112.8	112.7	111.6	112.7	114.3	113.3
100	212	156	56	6	144	141	144.8	144.4	144.8	144.9	145.6	145.1
100	212	150	62	6	119	112	118.2	117.9	115.3	113.3	113.1	112.8
100	161	113	48	4	115	110	114.6	114.7	113.9	113.6	113.7	113.4
100	174	128	46	3	122	119	122	121.7	121.3	121.8	122.5	122.3
99	182	124	58	5	132	127	130.8	130.9	130.4	131.8	132.5	132.4
100	217	162	55	3	117	102	114.8	114.5	113.6	113	113.5	113.7
100	270	186	84	4	123	101	121.2	120.5	118.1	116.3	114.4	115.7
100	171	123	48	2	115	110	115	114.9	114.9	116	116.4	116.7
100	171	115	56	1	127	126	126.9	127	127.9	129	129.8	128.8
100	250	178	72	12	121	104	122.6	122	120.5	119.5	119	118.3
100	199	141	58	1	117	111	116.9	116.8	116.4	116.4	116.7	116.8
100	223	158	65	2	119	109	117.6	117.9	118.2	118.1	118.4	117.8
100	179	136	43	1	116	107	115.6	115.2	112.8	112.9	112.5	113.1
100	202	148	54	4	126	119	124.8	124.7	124.2	124.8	125.3	125.2

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	208	153	55	5	140	138	140.8	140.8	139.8	139.9	139	138.8
100	189	140	49	1	131	130	131	130.9	132.1	133	133.7	133.2
100	205	147	58	8	132	129	131.8	131.8	131.8	132.4	132.8	133.5
100	197	151	46	7	141	139	140.9	140.9	141.2	141.3	141.8	141.7
100	217	147	70	4	116	106	115.7	115.8	116	116.3	117	117.6
100	185	114	71	3	119	109	116.8	117.1	116.9	116.8	118.6	118.9
100	185	114	71	3	119	109	116.9	117.2	117.3	117.6	118.1	118.2
100	203	152	51	4	139	135	138.9	138.8	139.2	139.3	139.6	139.9
100	221	156	65	3	119	104	116.6	116.5	117.1	117	117.2	117.6
100	190	136	54	5	120	112	120.4	120.8	119.9	121	120.8	121.2
100	199	137	62	6	116	101	115.8	115.3	115.2	114.4	113.3	112.9
100	188	136	52	2	117	106	116.4	115.9	113.8	112.8	113.5	114.4
100	172	131	41	3	140	140	140	140	140.2	140.4	140.9	141.1
100	191	130	61	7	117	110	116.4	116.4	115.6	115.5	116.3	116
100	212	149	63	2	113	100	112.9	112.7	112.5	112.4	112.6	112.7
100	204	156	48	5	124	109	122.4	122.5	120.4	119.4	119.3	119.3
100	184	122	62	3	113	100	111.9	111.6	112.3	112.8	111.7	111
100	201	134	67	4	112	103	114.7	114.4	112.7	112	112.5	111.9
100	228	175	53	4	143	138	142.8	142.6	142.4	142.8	142.4	142.4
100	219	157	62	3	128	124	127.6	127.8	124.7	123.9	123.1	122.6
100	220	151	69	6	120	103	119.4	118.9	118.5	117.3	115.9	116.3
100	180	125	55	3	116	112	115.8	115.8	114.5	113.6	113.8	113.9
100	208	136	72	2	122	114	122.8	122.3	120.8	119.6	119.7	120.8
100	218	155	63	3	124	107	124.6	124.1	121.2	120.1	118.5	119.1

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	208	143	65	5	121	112	120.6	120.2	118	117.5	117.4	117.3
100	202	145	57	5	119	108	118.9	118.7	118.6	117.4	118	118.9
100	220	153	67	3	124	116	123.8	123.3	121.8	121.3	121.3	121.1
100	193	135	58	1	130	127	129.6	129.5	128	128.6	129.1	129.5
100	185	125	60	2	119	111	118.8	118.8	118.9	119.2	119.2	119.9
100	211	154	57	4	128	120	127.4	127.3	126.7	126.5	126.4	126.5
100	202	141	61	8	130	126	129.7	129.7	129.4	130.2	130.6	130.4
100	185	131	54	4	118	113	118.9	118.8	118.4	119.1	120.1	118.9
100	211	154	57	4	127	118	126.4	126.4	125.4	125	124.8	125.3
100	217	153	64	3	117	102	118.4	118	115.3	115	114.4	114.5
100	201	148	53	5	127	123	127	126.8	126.9	127.2	128.1	128.3
100	193	136	57	4	114	112	113.6	113.8	113.8	114.3	116	115.8
100	206	152	54	8	122	105	122.2	122.2	120.5	119.1	119	119.3
100	149	102	47	3	121	121	121.1	120.8	121.1	121.9	122.7	122.9
100	216	147	69	1	128	124	127.9	127.8	128.8	129	130.7	129.7
100	215	156	59	3	114	106	114.8	114.7	114.5	115.7	116.8	116.4
100	203	147	56	2	125	119	124.7	124.4	122.9	123	122.7	121.8
100	210	148	62	3	158	158	158	158	158	158.1	158.8	159
100	209	137	72	7	126	124	125.9	126.1	125.8	126.6	127.5	127.5
100	236	175	61	5	122	111	121.8	121.8	121.1	122.1	122	122.9
100	242	168	74	7	125	115	123.3	123.1	121.5	120.3	119.7	120.5
100	180	124	56	3	132	132	132	132	132.1	132.3	133.1	133.6
100	185	124	61	3	116	104	113.6	113.8	113.9	114.2	115.1	114.7
100	249	173	76	6	138	131	137.3	136.9	133.3	131.8	129.4	130.8

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
98	178	127	51	3	113	103	112.8	112.4	111	110.9	110.2	110.8
100	190	142	48	2	139	135	138.8	138.6	137.9	137	137.2	137.4
100	239	167	72	2	119	100	119.5	118.8	117.2	115.3	113.3	113.4
100	194	144	50	3	142	141	141.9	142	141.7	141.9	142.2	142.4
100	206	152	54	8	122	105	122.8	122.5	119.6	118.8	117.8	118
100	220	149	71	5	120	112	119.9	119.8	120	120.4	120.3	121.5
100	179	125	54	3	110	102	110.2	109.7	109.8	111	112.6	112.9
100	209	137	72	8	123	112	123.3	122.8	120.7	119.6	119.3	119.5
100	174	120	54	7	116	110	115.9	115.7	116	116.6	116.9	117.1
100	215	152	63	10	129	127	129	128.9	129.3	129.9	132.3	132.1
100	213	145	68	10	118	103	118.4	118.1	117.4	115	114.3	114.1
100	220	160	60	14	132	123	131.7	131.5	131.3	131.4	131.6	131.6
100	183	135	48	14	121	115	121.8	121.4	119.1	119.5	119	118.8
100	188	130	58	5	117	109	115.9	115.7	115.7	115.4	117.1	117.5
100	185	134	51	15	137	136	136.9	136.9	137.3	137.3	138	138.5
100	199	138	61	8	144	144	144.1	144	144.5	144.9	145.6	145
100	198	144	54	11	124	119	124.7	124.7	124.7	124.6	125.6	125.3
100	209	145	64	10	132	130	131.9	132.2	132.3	132.9	134.5	135.3
100	220	160	60	14	132	123	131.7	131.8	131.7	130.9	132.3	131.1
99	252	190	62	14	139	131	138.7	138.4	137.1	138.2	138.4	138.4
100	167	110	57	9	126	125	125.9	126	126.5	127.5	130.2	129.5
99	233	161	72	8	139	137	138.9	138.8	138.5	137.6	138.1	138.2
100	221	158	63	14	122	106	121.6	121.4	119.9	120	119.7	119.7
100	232	157	75	10	123	112	121.8	121.8	122.2	124.2	124.8	124.6

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	198	153	45	11	121	116	118.9	118.9	119.1	119.3	120.3	120.3
100	190	145	45	14	123	117	123.7	123.6	124.2	123.7	124.9	124.6
100	191	131	60	7	120	114	119.8	119.9	120.3	120.7	120.3	120.8
99	196	142	54	12	115	106	112.7	112.9	112.8	113.5	115	114.2
99	216	152	64	6	144	144	143.9	144.1	144.2	144	144.8	144.6
100	161	127	34	7	117	110	119.7	119	116.9	115.5	113.5	113.2
100	191	139	52	5	121	112	120.8	120.6	120	119.9	121.4	120.5
100	217	152	65	12	126	120	125.7	125.4	124.1	123.6	124.4	123.3
100	203	139	64	10	150	150	150	150	150.1	150.1	151.2	151.4
100	187	137	50	11	121	113	121.6	120.9	119.5	119.2	119.6	119
100	211	141	70	10	117	105	116.6	116.3	114.7	116.1	116.7	116.2
100	198	143	55	8	117	106	116.9	116.7	117.2	116.5	117.2	117.6
100	224	147	77	9	119	104	118.4	118	117.5	117	116	116.1
100	177	132	45	11	120	118	120.7	120.7	121	121.8	121.6	121.6
100	211	160	51	17	125	114	125.8	125.6	124.8	123.4	123.5	123.4
100	176	122	54	7	116	105	116.7	116.9	116.3	116.8	117	116.4
100	180	131	49	9	135	132	134.9	135	135.1	135.2	135.7	136.1
100	167	113	54	7	123	118	122.9	122.8	123.5	124.3	125.4	124.6
100	197	144	53	7	155	155	155	155	155.9	157	157.3	158.3
100	529	380	149	23	187	187	186.9	186.9	186.7	186.8	186.7	186.8
100	195	139	56	9	132	127	131.8	131.4	130.6	130.3	130	131
100	220	161	59	12	130	120	129.6	129.4	128.1	128.1	126.1	126.5
100	214	171	43	13	120	105	120.7	120.1	119.4	118.8	118	118.6
100	199	145	54	11	132	132	132	131.9	132.1	132.8	134.9	135

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊢	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	250	174	76	7	126	114	126.7	125.6	123.9	122	121	122
100	227	157	70	16	122	109	121.7	121.6	120.8	120.3	120.9	120.5
100	218	154	64	8	129	127	128.9	128.9	129.4	130	131.3	131.2
100	184	122	62	9	114	102	112.9	112.6	113	113.9	113.2	113.8
100	180	132	48	7	116	111	115.9	115.8	115.7	116.5	117.4	117.5
100	213	145	68	10	125	119	126	125.7	125	123.5	122.5	122.8
100	177	129	48	6	132	132	132	132	131.9	132.1	132.6	132.8
100	229	163	66	9	121	108	120.8	120.6	118.6	116.8	116.6	115.7
99	193	141	52	5	121	108	119.7	119.1	117.9	118.7	119.4	119.8
100	195	128	67	1	117	108	116.8	116.8	115.5	115	115.5	115.1
100	180	132	48	10	115	103	112.8	112.4	112.6	111.9	113	114
100	189	138	51	9	118	117	117.9	118.1	117.3	117.9	117.8	118.2
100	217	162	55	6	119	103	116.8	116.8	115	114.6	114.2	114.8
100	202	138	64	17	120	107	120.5	120.5	119.9	120.9	120.3	120.1
100	192	132	60	4	130	121	129.7	128.6	125.4	123.8	122.7	121.9
100	193	128	65	13	123	110	124.5	124.1	122.3	121.5	121.8	122.3
99	220	141	79	10	126	125	126	125.9	126.3	127	127.9	128.2
100	213	129	84	7	131	129	130.9	130.8	130	130	131.3	130.7
100	192	140	52	13	116	105	115.8	115.8	115.6	116	117.1	118.2
100	183	132	51	9	126	123	125.8	125.8	125	125.4	125.9	125.1
100	209	135	74	12	127	120	126.8	126.8	125.6	125.7	125.3	126.9
100	209	146	63	13	140	140	140	140.1	140.8	141.5	144.6	144.1
100	216	161	55	14	118	106	120.7	120.4	118.2	117.7	117.8	117.7
100	194	130	64	7	129	129	129	129.1	129.3	130.6	131.3	131.8

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	211	155	56	17	117	107	117.7	117.7	117.2	117.5	119	118.1
100	232	175	57	12	126	114	125.4	124.7	123.3	122.5	119.9	120.3
100	251	183	68	15	135	132	134	134	134.3	135.2	136.2	136.4
100	245	165	80	7	124	112	123.7	123.7	122.6	122.9	122	122.8
99	211	155	56	12	147	147	147	147	147.1	147.1	148.9	150.9
100	193	142	51	6	124	118	123.8	123.8	123.1	123.7	123.7	123.2
100	213	160	53	19	138	138	137.9	137.9	137.8	138.4	138.1	138.6
100	190	130	60	12	123	113	121.8	121.8	121.1	121.2	122.9	122.4
100	184	133	51	6	115	106	115.3	115.1	114.5	114.3	114	114.3
100	219	160	59	7	119	102	118.6	118.3	117.5	117	117	117.2
100	188	136	52	7	113	103	110	110	110.9	111.9	112.4	112
100	239	174	65	4	119	100	118.4	117.5	115.6	113.8	113.4	114.2
100	241	155	86	17	160	160	160	160	160.2	160.3	161	161
99	209	155	54	9	128	116	124.8	124.4	124.1	123.8	123.1	123.1
100	218	162	56	10	137	137	137	136.9	137.8	137.9	138.7	139.2
100	208	149	59	11	127	115	127.4	126.8	124.9	122.9	121.5	121.1
99	217	149	68	8	142	142	142	142	142.1	142.2	143	143.5
100	204	144	60	11	138	137	138	138	138.2	138.2	139.8	140
100	174	119	55	11	148	148	148	148	148	148.1	148.6	149
100	193	131	62	8	117	109	119.8	119.7	119.8	120.6	120.7	121.8
99	226	159	67	14	138	137	137.9	137.8	137	137.3	137.8	137.5
100	204	140	64	15	122	108	121.8	121.1	120.5	118.7	117.6	116.8
100	183	129	54	10	115	103	115.7	115.7	115	114.8	114.2	115
100	195	149	46	8	133	132	133	133	132.7	133.2	136.2	137.3

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊢	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	240	171	69	13	125	105	126.3	125.9	121.7	120.9	119.3	119.4
100	201	143	58	15	138	138	137.8	137.8	137.8	138.3	140.5	140.5
100	195	148	47	2	124	121	123.8	123.8	123.4	123.8	123.7	124.1
100	215	160	55	16	136	134	136.8	136.6	135.4	135.5	135	134.7
100	209	142	67	10	128	116	126.8	126.8	127.3	127.4	127.9	127
100	178	119	59	11	116	110	115	115	116.3	118.3	119.8	120.6
100	227	170	57	15	139	139	139	139	139.4	140.5	141.7	143.1
100	210	149	61	16	123	115	121.8	121.7	121.4	121	121.8	121
100	286	199	87	20	144	140	143.8	143.9	143	142.9	143.9	143.4
100	201	148	53	8	129	126	128.7	128.7	128.8	129.1	129.1	128.9
100	174	130	44	8	129	129	129	129.1	129.9	130.4	131.7	131.2
100	183	127	56	39	128	121	127.8	127.8	128.8	128.3	129.4	130
100	172	132	40	43	129	126	128.9	128.8	128.7	129.4	128.7	128.7
100	200	148	52	47	131	119	130.4	130.7	129.4	128.4	128.5	129.8
100	196	139	57	34	125	118	124.8	124.7	124.9	124.6	126.4	125.9
100	200	151	49	35	129	128	128.9	129	129.4	130.5	133.3	133.7
100	215	152	63	42	131	118	131.9	131.6	130.4	129	128.3	127.1
100	195	130	65	45	130	124	130.8	130.8	129.9	129.4	130.8	129.8
100	193	138	55	31	141	141	141	140.9	141.1	141	141.2	141.3
100	199	151	48	32	142	139	142	141.8	141.7	141.5	141.3	141.4
100	205	151	54	49	144	143	145	144.9	145.1	144.9	146	146.5
100	200	148	52	32	129	125	128.8	128.8	128.9	129.3	130.6	131.1
100	220	153	67	44	137	134	137.8	137.7	136.9	136.8	137.6	137.5
100	192	131	61	38	130	126	129.8	129.4	129.3	129.9	131	131.1

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊢	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	203	139	64	44	156	156	156	156	156.1	156.3	157.3	158
100	263	187	76	50	135	120	135.1	134	131.8	131.7	130.1	130.6
100	211	143	68	32	142	140	140.9	141	140.8	140.4	142.1	142.8
100	246	180	66	35	126	108	125.3	125.2	124.3	123	122.8	122.8
100	187	142	45	39	152	150	151.9	151.8	151.3	151.9	152.9	152.6
100	233	171	62	37	135	121	135.7	135.1	132.8	131.1	130.6	129.9
100	202	146	56	44	141	138	140.9	140.9	141.3	141.6	144.2	143.8
100	288	214	74	56	147	133	147.8	147	146	145.4	144.6	144.1
99	200	149	51	42	128	118	127.8	127.7	127.2	126.9	126.6	127.1
100	263	197	66	51	159	156	158.4	158.3	157.6	158.3	159.6	158.4
100	208	150	58	46	153	153	153	152.8	152.4	152	152.7	153.4
100	235	167	68	52	165	164	164.9	165.2	165.8	167.5	169	168.4
100	241	179	62	50	149	148	148.8	148.9	148.9	149	150.1	151
100	244	169	75	63	159	154	158.8	158.6	157.3	156.4	156	155.8
100	186	130	56	40	128	124	128.7	128.4	127.4	126.7	126.1	125.5
100	235	167	68	52	165	164	165.1	165	166.1	167.2	169.5	169.3
100	218	153	65	57	145	142	145	144.8	145	145.4	145.8	145.5
100	184	134	50	41	124	119	122	122.2	124.5	126.7	128.9	128
100	194	133	61	46	164	164	164	164	164	164.1	165	165.3
100	220	156	64	43	124	119	123.9	123.9	123.7	125	126.1	125.4
100	228	170	58	51	150	148	149.9	149.8	149.8	150.3	151.6	151.9
100	286	199	87	67	167	165	167	166.7	166.5	166.8	167.4	166.9
100	214	155	59	38	135	130	134.8	134.7	134.7	134.7	136.3	136.8
100	227	156	71	44	140	131	139.6	139.4	138.6	138.9	140.1	138.9

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊢	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	239	176	63	56	149	145	148.9	148.9	148.9	149.2	150.1	150.5
100	210	158	52	38	141	139	141	141.1	141.6	142.3	143.2	143.8
100	202	156	46	40	134	126	133.6	133.4	131.1	130.2	128.3	128.6
100	230	156	74	43	142	142	141.9	141.8	141.6	141.4	143.3	143.9
100	206	153	53	39	135	127	132.8	132.4	131.6	132.1	132.4	133
100	213	160	53	44	144	139	143.7	143.7	143.9	143.3	143.8	143.4
100	213	140	73	40	136	126	135.4	135.4	133.8	132	132.7	132.3
100	169	125	44	32	131	131	131	130.9	131.4	132.7	133.9	135
100	184	122	62	37	123	117	122.7	122.7	122	121.6	122.1	122.7
100	260	180	80	49	147	139	146.8	146.3	145.9	144.8	144.6	144.8
100	165	114	51	40	124	121	124.7	124.3	123	123.1	123.5	123.8
100	229	149	80	48	140	130	140.6	140.2	138.5	139.8	141.3	140.7
100	198	143	55	41	126	119	126.6	126.9	127.3	127.4	127.7	128.1
100	209	148	61	34	141	138	141.8	141.9	141.6	141.9	144.3	143.6
100	196	150	46	29	125	120	124.8	124.1	123.2	124	125.2	124.7
100	187	133	54	42	137	136	136.8	137	137.6	138.5	139.7	139.3
100	214	146	68	44	155	155	155	155	155	155	154.8	154.9
100	171	123	48	27	120	119	119.9	119.9	120.6	121.5	123.8	122.7
100	201	148	53	49	140	137	139.9	140	140.1	140.9	142.1	142.7
100	182	134	48	35	159	159	159	159	159.1	159.6	160.6	161
100	197	134	63	43	120	110	119.4	119.6	118.4	118.7	119.2	119.4
100	211	144	67	37	130	125	129.7	129.4	128.5	128	129.1	128.7
100	221	157	64	39	129	117	128.4	128.3	126.5	126.2	126	125.5
100	169	118	51	37	130	129	129.8	129.6	128.6	129	129.3	129.8

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	236	175	61	49	140	132	138.9	138.7	138.9	139.6	140.5	139.4
100	181	128	53	42	148	148	148	147.8	147.8	147.9	147.2	148.2
100	191	136	55	39	138	137	138	137.8	138.5	139.1	138.6	138.6
100	228	159	69	40	151	148	150.8	150.6	150.7	150.8	150.8	151.1
100	181	131	50	42	125	123	124.9	124.9	124.8	124.2	123.9	124.2
100	179	136	43	45	127	124	126.8	127.1	126.4	126.7	127	127.5
100	216	159	57	34	136	135	136	136	136.2	136.4	138.7	139
100	220	153	67	44	137	134	137.8	137.4	137	136.6	137.4	138.2
99	197	151	46	37	133	128	131.9	131.4	130.9	130.2	129.6	129.5
100	189	140	49	38	134	131	133.9	133.9	134.3	135.4	136	136.9
100	241	183	58	49	161	158	161	160.7	160.5	160.8	160.8	161.3
100	200	137	63	36	135	132	134.8	134.7	132.8	132.2	132.1	132
100	203	151	52	45	156	156	156	156	156	156	156	156
100	190	126	64	38	129	121	128.7	127.9	126	124.9	124.7	124.9
100	247	168	79	45	136	131	136.9	136.6	136.4	135	134.3	134.8
100	226	161	65	50	139	126	139.8	139.3	136.7	136.3	135.3	134.8
100	225	172	53	48	149	147	148.8	148.5	147.9	148.2	148.2	148.4
100	185	136	49	33	128	124	127.9	128.1	128.4	128.9	130.4	130.8
100	182	135	47	33	126	120	125.9	125.6	125.8	125.1	125.7	125.6
100	229	149	80	48	140	130	140.4	140.1	139.5	139.8	139.9	141.2
100	166	123	43	24	123	118	122.8	123.1	123.9	124.4	125.4	124.8
100	218	154	64	49	159	159	159	159	159.2	159.3	161	161.8
100	191	136	55	38	129	124	125.8	125.9	125.5	125.7	127	129.2
100	197	147	50	40	127	121	127.8	127.8	128.3	128.9	128.3	128.9

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	213	144	69	50	153	153	153	153	153.1	153	153.8	154.3
100	155	106	49	28	120	116	119.9	119.6	119.1	118.4	118.9	119.6
100	222	166	56	41	134	126	134.4	134.4	133.3	133.3	132.1	132.6
100	224	147	77	42	131	121	129.9	129.4	129.5	128.6	130.1	130.3
100	212	148	64	36	127	119	125.9	125.4	124.4	124	122.5	123.6
100	192	154	38	35	132	124	130.8	130.4	130	129.1	130.1	130.3
100	216	149	67	37	131	125	131.6	130.9	129.5	128	126.5	127.9
100	196	148	48	40	132	130	131.8	131.8	131.3	131.6	132.2	132.6
100	223	151	72	48	131	126	130.7	130.4	129	129.7	129.6	129.2
100	212	165	47	38	131	121	130.3	130.4	128.8	129	129.4	129.1
100	208	157	51	41	128	115	128.7	128.9	128.4	129.2	131.8	131.3
100	204	140	64	46	132	121	130.6	130.1	129.8	129.2	128.3	128.2
100	195	140	55	51	139	134	138.9	138.6	137.5	138	137.2	139.2
100	204	142	62	39	136	133	135.7	135.6	134.5	133.7	133.5	133
100	212	156	56	44	128	121	128.4	128.4	127.1	126.1	126.1	125.5
100	239	178	61	111	167	162	166.8	166.7	166.7	167.2	167.9	168
100	188	124	64	101	151	148	149.9	149.9	149.9	150.7	151.9	152.3
100	218	153	65	118	171	171	171	171.1	171.1	170.7	172.2	172
100	239	174	65	98	157	152	156.9	156.8	156.4	155.9	156.3	156.8
100	231	160	71	119	169	168	169	168.9	169.1	169.4	170.5	170.5
100	223	159	64	111	170	168	169.8	169.8	169.3	168.1	169.6	168.5
100	212	149	63	113	166	163	166.9	166.8	166	165.6	165.5	165.5
100	239	161	78	115	172	167	171.8	171.8	171.4	171.1	171.6	171.8
100	211	148	63	103	175	174	175	175	175.6	176.1	178	178.4

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊢	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	241	174	67	124	187	187	186.9	186.9	187.2	187.3	188.5	189.3
100	230	170	60	124	176	175	176	176	175.8	176.2	176.3	175.3
99	212	153	59	116	166	163	165.9	165.9	165.8	167	167.9	166.9
100	212	158	54	103	160	155	160	160.1	159.7	160.3	160.1	160.7
100	162	117	45	70	140	138	139.9	139.7	139.6	139.4	140.4	140.2
100	205	154	51	106	168	168	167.9	167.9	168.3	168.3	170	169.8
100	189	135	54	96	151	151	151	150.9	151.8	152.9	154.3	154.8
100	220	159	61	103	180	180	180	180	180.3	181	183.8	184.5
100	222	150	72	110	165	162	164.8	164.8	164.7	164.6	166.8	165.6
100	176	123	53	97	151	151	150.8	151.1	151.3	151.9	154.5	153.8
100	190	126	64	89	147	144	147.8	147.6	147.1	147.2	145.8	146.1
100	186	132	54	99	152	151	152.7	152.8	152.1	152.2	152.1	152
100	205	147	58	98	163	163	163	162.9	163.7	163.9	165.4	166.3
100	168	123	45	93	145	144	144.8	144.7	144.1	144.9	145.4	145.6
100	198	128	70	102	154	150	153.9	153.8	153.9	154.4	156.2	155.3
100	256	193	63	122	187	186	186.8	186.9	186.1	185.9	187.9	187.4
100	184	122	62	81	136	135	136.8	136.4	135.5	135.6	136.4	136.7
100	253	179	74	126	188	188	187.9	187.8	188.3	188.2	188	188.3
100	200	132	68	99	154	151	154	153.8	152.3	152.5	152.4	152.1
100	195	139	56	100	159	157	158.9	158.9	159.2	159.5	159.9	160.1
100	208	144	64	104	151	146	150.9	150.9	150.6	151.6	153.8	154.3
100	204	151	53	116	158	154	157.9	157.8	157.5	157	157.1	156.9
100	199	151	48	99	151	146	150.9	150.7	150.6	150.4	151.1	150.9
99	204	151	53	100	171	170	171	170.9	171.1	171.9	173.3	173.7

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊢	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	205	142	63	105	177	177	177	176.8	176.9	176.4	177.1	176.9
100	197	141	56	101	158	156	157.9	157.8	157.6	157.4	158.9	159.3
100	246	180	66	106	161	154	160.6	160.3	159.5	159.5	160.4	159.8
100	189	138	51	85	145	143	144.8	144.7	143.7	143.7	143.1	142.7
100	203	143	60	95	157	156	156.9	156.9	157.2	157.4	159.5	158.9
100	174	130	44	72	148	148	148	148	148.8	149.7	151.3	151.5
100	177	120	57	100	148	146	148	148.1	148.2	148.6	150.8	149.9
100	210	159	51	97	168	168	168.1	167.9	167.9	169.1	170.8	170.9
100	187	129	58	92	157	155	157	157	157.3	157.4	159.3	159.8
100	212	153	59	114	173	172	173	172.9	173.1	173.2	174.1	174.5
99	173	125	48	80	137	133	136.8	136.9	137.3	136.5	138.5	137.6
100	206	145	61	88	150	148	149.9	149.9	150.6	152.5	154.6	155
100	205	147	58	98	163	163	162.9	163	163.1	163.8	165.2	166.1
100	208	144	64	104	151	146	150.8	151.1	150.9	151.8	153	153.2
100	204	134	70	102	161	161	160.9	160.8	161.3	161.3	162.6	163.2
100	219	156	63	115	174	173	174	174	174.2	174.4	176.5	176.5
100	254	173	81	123	174	169	173.9	173.9	173.4	173.6	176	176
100	200	155	45	91	154	150	155	154.9	154.6	155.6	156.3	156.9
100	206	137	69	104	159	152	158.8	158.7	158.4	158.8	158.4	158.1
100	237	159	78	109	168	164	168	168.1	168	168.4	170.3	170.8
100	236	154	82	117	163	160	162.9	162.8	163.1	162.9	163.7	163.2
100	232	168	64	98	161	154	160.4	160.1	159	158.9	159	159.1
100	159	115	44	83	143	143	142.9	142.7	142.6	142.8	145.2	145.8
100	198	145	53	91	148	143	146.8	146.7	146.1	145.4	145.5	146

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊢	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	226	158	68	115	159	154	157.9	157.9	158.3	158.6	158.3	159
100	181	124	57	82	146	146	145.9	145.8	145.8	146.6	147.9	148.4
100	267	183	84	131	178	166	177.8	177.5	175.5	176.5	177	177.3
100	231	160	71	106	179	179	178.9	179	178.4	178.3	177.6	178.1
99	193	135	58	95	147	143	146.9	146.8	146.5	147.6	147.9	147.7
100	257	180	77	120	176	170	176.8	176.4	175.6	176.1	176.7	176.5
100	203	137	66	93	161	159	160.8	160.8	160.7	160.1	161.3	161.2
100	180	125	55	104	148	146	148	147.8	148.3	148.9	148.9	148.9
100	200	138	62	101	151	147	151	151	151.1	151.9	155.5	155.4
100	183	131	52	87	138	135	138.1	137.9	137.6	137.7	137.4	137.8
100	192	145	47	96	176	176	176	176	176.5	177	179.7	180
100	190	138	52	83	139	134	138.9	138.9	139.6	139.9	141	141
100	180	131	49	78	151	151	151	151	150.9	151.4	152.6	153
100	222	164	58	112	165	162	164.9	164.8	164.1	164.6	164.1	163.6
100	214	150	64	106	171	171	171	171	171.4	172.5	173.5	174.5
100	236	169	67	111	186	186	186.1	186.1	185.9	187.1	188.5	188.3
100	173	113	60	89	142	141	141.7	142	142.3	142.6	144.6	144.8
100	246	180	66	106	161	154	160.8	160	159.8	159.1	159.4	159.6
100	211	154	57	111	174	174	173.9	173.8	174	174.4	175.5	175.9
100	240	171	69	119	172	170	171.9	171.9	172.2	172.3	174.8	174.1
100	196	142	54	95	149	144	148.9	148.8	148.2	148.4	148.1	147.9
100	214	154	60	108	168	165	167.8	167.9	167.2	168.3	169.8	170.2
100	255	168	87	127	179	176	178.8	178.6	178.1	178.5	181	180.8
100	191	132	59	93	156	155	156	156.1	156.4	156.6	158.3	159.8

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
100	189	130	59	106	161	157	160.9	160.4	159.5	159	158.6	158.2
100	159	120	39	67	136	136	136	136	135.8	136.2	137.1	137.4
100	181	123	58	92	157	157	157	157	157.2	157.3	157.9	158.1
100	238	166	72	113	164	160	164	163.8	163.4	162.4	161.7	161.3
100	192	144	48	93	164	164	164.1	164	164.8	164.6	165.4	165.2
100	216	161	55	119	178	177	177.9	177.9	178.4	178.9	179.9	179.5
100	168	115	53	74	136	133	135.8	135.8	135.2	135	136.3	136.6
99	212	147	65	114	165	163	165	165.1	165.6	166.6	169.1	169.2
100	210	147	63	110	162	160	162	161.9	161.7	161.7	162.7	162.2
99	204	152	52	103	161	161	161	161.1	161.1	161.3	163.4	163.4
100	187	134	53	75	142	140	141.9	141.9	142.2	143.1	144	144
100	202	144	58	107	160	155	159.8	159.7	159.6	159.8	160.9	159.8
100	208	146	62	100	161	158	160.9	160.8	160.9	162.3	163	162.6
100	235	168	67	119	175	174	174.9	174.8	175.1	176.4	178.7	178.7
100	205	135	70	95	173	173	173	173	173.1	173.1	174.6	174.7
100	218	153	65	118	171	171	171	170.8	171.2	171.1	171.6	172.2
100	218	153	65	118	171	171	171	170.9	171.1	171.6	172.4	171.9
99	209	165	44	105	172	171	171.9	171.9	172.1	172.7	172.9	173.1
100	225	172	53	118	182	181	181.8	181.9	181.4	181.4	182.7	182.7
265	642	530	112	33	324	306	327.8	327.3	325.9	323.9	321.5	321.3
267	565	444	121	33	359	355	359	358.8	358.8	358.6	358.1	358.3
259	663	522	141	15	336	327	334.9	334.8	334.8	334.5	334.7	335
273	718	576	142	33	434	430	433.9	434	433.8	434	433.8	433.2

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
282	784	643	141	30	385	377	386	385.9	385.2	385.2	385.5	386
262	687	552	135	31	337	328	336.9	336.7	336.4	336.5	334.7	334.9
253	665	518	147	33	416	416	416	416	416	416.1	416.3	416.6
268	643	508	135	30	494	494	494	494	494	494	494	494
269	722	583	139	32	422	420	422	422	421.8	421.8	421.7	421.8
265	733	567	166	34	400	400	400	399.9	399.9	399.7	399.8	400.9
267	720	588	132	41	366	360	365.9	365.9	365.7	364.8	364.3	364.2
250	637	520	117	34	309	295	309.9	309.8	309.2	309	307.5	307.5
271	774	622	152	31	336	315	334.8	334.8	333.4	332.5	329.3	329.2
268	595	471	124	22	328	320	327	326.8	327	327.1	327.5	326.8
265	674	548	126	43	363	359	362.9	362.9	362	361.8	361.5	361.5
262	627	502	125	30	340	327	340.9	340.9	339.7	339.1	337.5	338.3
271	746	586	160	38	356	343	355.8	355.7	354.6	353.7	351.9	351.5
271	661	544	117	33	366	359	366	365.9	365.6	365.3	365.1	365.1
272	736	613	123	40	364	353	364.9	364.7	364.4	363.8	362	361.8
267	687	558	129	25	366	361	365.9	365.8	365.4	365	364.6	365.3
263	648	514	134	37	321	299	324	323.8	322.3	319.8	316.2	315.4
261	676	545	131	31	340	332	339.9	339.8	339	338.5	336.8	336.1
265	721	568	153	35	409	406	408.9	408.9	408.5	408.4	407.8	408.6
261	694	556	138	32	354	348	353.9	353.9	353.8	353	352.3	352.1
257	649	513	136	41	334	325	335.8	335.8	335	334.1	333.3	332.8
268	725	591	134	31	356	345	357.9	357.8	357.1	356.3	355.3	354.8
274	628	506	122	36	427	426	427	427	427	426.8	427.6	427.8
271	686	537	149	33	331	313	330.8	330.4	329.3	328.3	324.1	321.6

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊥	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
261	684	562	122	38	352	335	350.9	350.9	349.9	349.3	348.4	348.7
262	708	587	121	30	352	342	353.9	353.4	352.8	351.5	346.7	346.4
281	738	588	150	42	354	336	354.8	354.8	353.8	353.6	353.9	353.1
269	674	531	143	34	364	356	363.9	364.1	363.8	363.8	362.9	363.6
268	731	575	156	33	340	318	340.8	340.7	339	337.9	334.4	334.2
274	711	556	155	24	362	351	359.9	359.9	359	358.8	357.8	358.8
274	682	540	142	45	353	339	353.9	353.9	353.1	352.5	350	350.3
270	740	573	167	41	373	352	373.5	373.4	373	371.3	365.9	364.4
272	744	579	165	42	352	333	352.9	352.7	352.2	351	350.8	350.7
265	658	511	147	33	349	343	347.9	347.8	347.1	347.3	346.8	347.5
267	720	593	127	33	349	338	346.8	346.7	346.3	345.4	346.1	345.5
260	695	540	155	33	443	443	443	443	443	443	443.2	443.2
264	671	527	144	30	337	326	337.7	337.8	336.2	335	332.7	332.5
264	701	575	126	34	333	312	332.7	332.4	330.8	328.7	323.9	324.3
270	712	582	130	32	325	302	326.8	326.5	324	323.2	320.1	318.4
275	705	558	147	30	352	338	352	351.7	351.6	351	349.5	349.9
896	2557	2024	533	128	1181	1132	1181	1181	1181	1181	1181	1181
904	2280	1853	427	127	1162	1129	1162	1162	1162	1162	1162	1162
882	2398	1924	474	107	1078	1014	1078	1078	1078	1078	1078	1078
890	2564	2035	529	122	1139	1081	1139	1139	1139	1139	1139	1139
895	2446	1953	493	106	1211	1178	1211	1211	1211	1211	1211	1211
887	2482	1983	499	128	1144	1095	1143	1143	1143	1143	1143	1143
890	2476	1990	486	144	1424	1422	1424	1424	1424	1424	1424	1424

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.

Table 1 (Continued)

vertices	vdges				edges after reduction	lower bound for OPT	average number of edges after adding random edges and doing transitive reduction (100 runs)					
	total	→	⊢	critical			5 edges added	10 edges added	50 edges added	100 edges added	500 edges added	1000 edges added
901	2606	2091	515	129	1194	1142	1194	1194	1194	1194	1194	1194
894	2497	1992	505	107	1154	1106	1154	1154	1154	1154	1154	1154
887	2412	1927	485	110	1203	1159	1205	1205	1205	1205	1205	1205
886	2402	1920	482	122	1167	1123	1167	1167	1167	1167	1167	1167
895	2496	2007	489	97	1133	1076	1133	1133	1133	1133	1133	1133
903	2522	2023	499	105	1136	1068	1135	1135	1135	1135	1135	1135
895	2449	1980	469	125	1177	1129	1177	1177	1177	1177	1177	1177
888	2482	1959	523	122	1250	1223	1251	1251	1251	1251	1251	1251
905	2672	2119	553	120	1192	1147	1192	1192	1192	1192	1192	1192
907	2577	2067	510	120	1166	1125	1166	1166	1166	1166	1166	1166

Table 1. Performance of our transitive reduction algorithm on simulated biological networks. We first generate the random network and then apply our algorithm for BTR to get a reduced network. The subsequent columns show the results when a certain number of edges are added randomly that do not change an optimal solution of the original graph.