A Comprehensive Computational Results

Tables 1, 2, 3, and 4 present exhaustive computational results for large (those requiring ≥ 1 hour of run time), medium (those requiring between 1 hour and 1 minute of run time), small (those requiring between 1 minute and 0.1 seconds of run time) and tiny (those requiring less than 0.1 seconds) instances, respectively. In each table, the first five columns give the name (or index from SJ database), dimension, number of nonzeros, MATLAB estimated condition number, and MATLAB estimated sparse norm in each matrix. Column 6 gives the run time of SPEX Left LU using the selected pivoting scheme tol 0. Lastly, columns 7 and 8 give the relative run time of Wiedemann and Lanczos, respectively. Note that those instances in which these algorithms seg-fault are indicated with **SF** and those instances whose solutions were incorrect are indicated with bold red text.

						Relative Run Time	
Matrix Name	n	nnz	Cond	norm	SPEX time (hr)	Wiedemann	Lanczos
366	20640	97353	2.03E+15	7.69E+05	24.00	**SF**	**SF**
400	10964	233741	1.29E+15	1.99E+01	21.14	0.05	0.04
365	20545	85537	4.05E+21	3.38E+09	18.90	**SF**	**SF**
388	11532	44206	5.88E+12	2.90E+08	17.01	**SF**	**SF**
369	10000	49699	6.90E+20	4.31E+04	16.72	0.02	0.03
385	10672	232633	2.34E+14	1.89E+01	15.92	**SF**	**SF**
367	7337	156508	7.64E+13	1.83E+01	8.05	0.06	0.05
359	13436	71594	3.82E+15	1.41E+04	7.75	**SF**	**SF**
695	14454	147972	3.10E+12	5.31E+03	7.74	0.12	0.11
696	14454	147972	2.96E+12	5.31E+03	7.72	0.11	0.11
368	7337	154660	1.87E+24	1.83E+01	7.38	0.06	0.05
350	6774	33744	7.68E+13	1.26E+06	7.13	0.02	0.02
352	5773	71701	8.73E+12	1.29E+08	5.42	0.04	0.04
336	5005	20033	6.90E+16	6.76E+06	5.35	0.02	0.01
88	4875	315891	3.70E+16	3.47E-10	5.31	***0.05**	***0.04**
344	3363	99471	4.08E+13	3.79E+09	5.07	0.04	0.03
119	3251	65875	2.62E+16	1.27E+07	4.85	0.02	0.02
213	3402	130371	2.67E+16	3.98E+14	4.70	0.03	0.03
117	3973	79077	2.94E+19	1.28E+02	4.66	0.03	0.03
337	5321	65693	2.10E+13	4.68E+06	4.66	0.03	0.03
346	7055	30082	1.65E+12	4.02E+02	4.38	**SF**	**SF**
347	7055	30082	6.34E+17	4.02E+02	4.24	***0.03**	***0.03**
140	3937	25407	1.04E+17	3.27E+11	3.88	0.02	0.02
120	2163	74464	4.36E+16	8.16E+01	3.49	0.02	0.01
142	3937	25407	1.04E+17	3.27E+11	3.45	0.02	0.02
222	4257	37465	2.52E+16	1.46E+02	3.21	***0.03**	***0.02**
221	4257	37465	2.52E+16	1.46E+02	3.21	***0.02**	***0.02**
364	13935	63307	2.35E+18	1.26E+05	3.20	**SF**	**SF**
223	4257	37465	1.74E+19	1.46E+02	3.10	***0.02**	***0.02**

						Relative Run Time	
Matrix Name	n	nnz	Cond	norm	SPEX time (hr)	Wiedemann	Lanczos
341	2880	18229	9.74E+13	1.39E+04	2.62	0.01	0.01
349	4101	82682	1.44E+13	1.34E+01	2.60	0.06	0.05
130	2880	18229	5.98E+18	1.33E+07	2.25	0.01	0.01
138	4101	81057	1.80E+24	1.34E+01	2.17	0.06	0.05
pilot87.pre	1540	30916	Inf	Inf	1.70	0.02	0.02
118	2568	75628	4.01E+15	1.26E+10	1.57	0.07	0.06
pilot87	1625	31396	Inf	Inf	1.14	0.02	0.02
156	4800	102252	3.46E+61	3.63E+05	1.06	0.13	0.12

Table 1: Comprehensive Results: Large Instances

						Relative Run Time	
Matrix Name	n	nnz	Cond	Norm	SPEX time (min)	Wiedemann	Lanczos
217	4720	20042	3.51E+48	1.89E+02	52.61	0.08	0.08
gen4	375	8919	8.43E+236	Inf	47.79	0.02	0.02
gen4.pre	367	9322	Inf	Inf	43.30	0.02	0.02
self	924	157411	1.20E+07	1.57E+11	41.18	0.03	0.03
slptsk	2315	34430	4.35E+185	NaN	35.48	0.27	0.29
260	1000	1000000	1.15E+14	5.36E-01	33.21	***0.49**	***0.47**
335	6747	29195	2.22E+18	5.41E+08	33.12	0.23	0.21
gen1	329	11016	Inf	Inf	28.96	0.04	0.04
57	3008	20698	2.37E+28	8.44E+09	19.43	0.09	0.09
207	1919	32399	2.10E+18	2.92E+00	19.40	0.06	0.07
155	3200	68026	1.78E+47	1.61E+05	19.16	0.20	0.18
55	3008	20715	1.94E+27	7.90E+08	18.24	0.08	0.08
87	2500	12349	4.35E+17	9.83E+03	17.91	0.07	0.07
154	1280	47906	9.87E+24	7.94E+04	16.28	0.06	0.05
122	1651	49062	8.22E+27	4.49E+02	13.93	0.13	0.11
329	5308	22680	1.67E+14	2.99E+06	11.09	0.52	0.45
330	5308	22592	1.66E+14	2.99E+06	11.08	0.51	0.44
159	1050	26198	9.00E+15	2.10E+07	10.58	0.06	0.06
pla8_sig185	39835	196256	4.29E+09	1.04E+03	10.43	0.27	0.25
355	1409	42760	2.28E+13	2.67E+05	9.31	0.18	0.16
pilot	1132	16624	1.12E+175	NaN	6.88	0.05	0.05
320	1733	22189	1.20E+13	1.18E+11	6.02	0.25	0.25
maros-r7	1350	31923	7.43E+06	3.99E+10	5.89	0.05	0.04
236	1000	1000000	1.46E+19	3.23E+00	5.49	***3.00**	***2.88**
340	8765	42471	6.15E+14	1.00E+15	5.10	**SF**	**SF**
jendrec1	1779	34196	9.54E+217	NaN	5.08	2.76	2.66
stat96v4	3139	23752	9.62E+17	1.63E+21	4.85	0.23	0.22
58	3083	11767	2.30E+21	1.21E+09	4.78	0.34	0.31
pla85900.nov21	40304	230558	5.46E+08	9.76E+02	4.77	0.67	0.65
momentum3	3254	15159	Inf	Inf	4.25	0.38	0.36

						Relative Run Time	
Matrix Name	n	nnz	Cond	Norm	SPEX time (min)	Wiedemann	Lanczos
153	765	24382	1.67E+14	1.35E+17	4.20	0.14	0.13
232	1000	1000000	4.50E+21	8.11E-01	4.02	***4.16**	***3.84**
54	3268	20712	1.27E+27	2.50E+12	3.26	0.58	0.55
240	1000	1000000	1.44E+22	6.46E+00	3.11	***5.47**	***5.46**
296	1258	7682	1.03E+13	2.05E+07	2.68	0.13	0.12
256	1000	1000000	1.06E+23	2.99E+00	2.65	***6.45**	***6.05**
56	3268	20963	1.27E+27	2.50E+12	2.54	0.86	0.76
cont11_l	58936	179556	3.65E+26	7.37E+00	2.46	0.01	0.01
264	1000	1000000	8.23E+21	4.47E-01	2.19	***7.11**	***6.86**
mod2.pre	4422	12914	3.72E+246	NaN	2.18	1.48	1.40
brd14051	16360	180847	2.96E+08	2.74E+02	2.14	0.60	0.58
world	4261	12190	5.65E+241	NaN	2.10	1.30	1.23
157	4800	27520	1.03E+14	2.20E+00	2.05	1.75	1.61
fome13	24884	70839	7.99E+15	4.02E+11	1.94	0.58	0.53
121	1159	11047	1.57E+19	1.17E+02	1.85	0.21	0.20
mod2	4435	12985	1.38E+223	NaN	1.78	1.74	1.65
160	1374	8588	4.11E+15	1.10E+03	1.69	0.24	0.24
309	2837	10967	5.85E+12	7.41E+05	1.64	0.97	0.90
314	2836	10965	5.85E+12	7.41E+05	1.64	0.96	0.88
l30	2492	12653	1.73E+08	2.61E+09	1.56	0.33	0.30
259	500	250000	1.15E+14	5.36E-01	1.24	***1.71**	***1.69**
scfxm1-2r-256	11812	44985	3.12E+12	2.84E+08	1.15	2.95	2.65
332	4101	36879	6.70E+20	2.02E+06	1.11	2.93	2.53

Table 2: Comprehensive Results: Medium Instances

						Relative Run Time	
Matrix Name	n	nnz	Cond	Norm	SPEX time (s)	Wiedemann	Lanczos
gen2	328	8894	1.84E+11	4.51E+18	54.10	0.10	0.07
310	3200	18316	2.02E+13	2.20E+00	48.00	2.24	2.07
128	760	5739	1.12E+16	3.10E+08	43.91	0.19	0.18
129	760	5816	9.93E+19	3.10E+08	42.15	0.19	0.18
nemswrld	2205	13323	NaN	Inf	39.39	0.54	0.49
210	1484	6110	5.57E+17	1.26E+16	31.32	0.87	0.81
cont4	2802	11862	3.85E+05	3.98E+03	30.32	0.51	0.48
nug30	14681	45627	1.06E+06	7.88E+00	30.07	0.88	0.79
nug20	7733	31455	8.84E+07	7.26E+00	28.82	0.40	0.34
rat5	902	12026	4.19E+06	7.48E+05	26.66	0.17	0.16
stat96v1	5013	20325	6.35E+32	8.22E+20	25.24	0.66	0.62
51	1813	11246	3.82E+14	1.22E+00	20.19	***1.63**	***1.52**
stat96v2	12928	48009	1.06E+13	1.32E+10	20.04	1.87	1.79
nug15	5486	24736	2.41E+07	7.73E+00	19.96	0.31	0.28
141	511	2796	6.37E+15	4.21E+10	19.26	0.20	0.18

						Relative Run Time	
Matrix Name	n	nnz	Cond	Norm	SPEX time (s)	Wiedemann	Lanczos
pilot.ja	567	3781	Inf	Inf	19.14	0.43	0.39
231	500	250000	8.37E+20	8.11E-01	18.84	***6.80**	***6.79**
144	511	2796	6.37E+15	4.21E+10	18.83	0.22	0.18
235	500	250000	4.74E+18	3.23E+00	18.57	***7.28**	***7.10**
pla33810	18940	123445	1.05E+08	2.20E+02	17.15	2.94	2.69
stat96v3	13485	49917	3.93E+12	6.98E+09	16.99	2.21	2.07
model10	1341	6403	1.71E+164	Inf	15.92	0.90	0.77
d2q06c	1047	5717	1.82E+188	Inf	14.96	0.73	0.63
239	500	250000	4.54E+20	6.46E+00	14.81	***9.17**	***9.20**
d15112	9197	47335	2.33E+18	2.25E+11	14.53	3.10	2.92
watson_1	5729	14544	7.98E+58	9.72E+55	13.98	6.80	6.40
315	2053	18447	6.71E+16	2.03E+04	13.37	3.73	3.44
rat7a	641	10542	1.38E+20	5.06E+05	13.18	0.20	0.18
progas	1167	6500	8.15E+103	6.78E+100	12.63	1.19	1.09
scfxm1-2b-64	5966	22682	1.30E+12	2.84E+08	12.57	4.12	3.82
255	500	250000	1.07E+22	2.99E+00	12.47	***10.58**	***10.36**
scfxm1-2r-128	5671	21943	1.64E+12	2.84E+08	12.27	3.96	3.73
stat96v5	812	3795	1.42E+63	3.93E+64	12.08	1.33	1.20
qap12	2740	12014	2.46E+07	6.84E+00	11.79	0.14	0.12
124	1220	5892	2.24E+34	2.87E+00	10.16	1.66	1.53
NSR8K	5387	46157	2.64E+07	2.06E+03	9.91	0.93	0.81
watson_1.pre	4642	12991	3.44E+58	9.72E+55	9.83	7.13	6.72
co9	2287	13481	2.32E+49	1.56E+42	9.68	1.58	1.42
301	1650	7419	5.63E+12	5.15E+02	9.65	2.84	2.58
l30.pre	1199	6030	1.79E+06	2.61E+09	8.49	0.49	0.46
127	1220	5855	6.25E+14	3.70E+02	8.48	1.97	1.74
291	1220	5860	1.80E+13	8.78E+00	8.35	1.98	1.85
126	1220	5884	1.06E+14	9.34E+00	8.33	2.00	1.78
293	1220	5892	1.58E+13	8.37E+00	8.21	2.05	1.91
newman2	468	7917	1.39E+225	Inf	8.10	0.39	0.37
125	1220	5892	1.58E+17	2.88E+00	8.08	2.07	1.82
289	1220	5884	1.42E+13	4.95E+00	7.85	2.13	1.99
292	1220	5888	3.45E+13	2.02E+01	7.84	2.11	1.95
287	1220	5888	4.14E+13	1.63E+01	7.60	2.17	1.93
288	1220	5852	2.74E+13	1.23E+01	7.60	2.17	2.02
stormg2_1000.pre	13926	32547	2.13E+11	2.59E+05	7.43	12.82	12.77
212	882	3354	7.98E+16	6.69E+12	7.20	1.33	1.12
209	415	2779	8.19E+17	6.47E+00	7.14	0.41	0.34
294	1220	5892	2.74E+13	1.23E+01	7.12	2.54	2.63
158	416	8562	2.42E+25	2.54E+03	7.02	0.60	0.57
263	500	250000	2.57E+21	4.47E-01	6.97	***17.74**	***18.10**
momentum2	2113	6516	2.52E+39	1.88E+37	6.95	1.61	1.40
pilotnov	549	3337	2.82E+264	NaN	6.53	0.95	0.80
nug12	2736	12037	2.25E+07	6.97E+00	6.48	0.32	0.22

						Relative Run Time	
Matrix Name	n	nnz	Cond	Norm	SPEX time (s)	Wiedemann	Lanczos
stormg2_1000	14075	32597	3.77E+09	1.05E+04	6.46	15.44	14.78
295	3562	3562	1.81E+13	1.02E+06	6.23	17.41	15.82
perold	440	2584	4.45E+256	NaN	6.16	0.84	0.72
scfxm1-2r-96	4504	17205	1.35E+12	2.84E+08	6.03	4.92	4.51
53	1089	4144	6.05E+14	2.91E+04	5.77	2.02	1.95
dbic1	4795	23403	1.04E+11	4.53E+06	5.59	1.75	1.47
pilot4	289	2805	Inf	Inf	5.19	0.87	0.81
211	768	2934	1.29E+17	1.36E+13	4.95	1.53	1.27
cont1_l	1070	4649	1.22E+09	2.51E+05	4.55	0.88	0.79
model11	2039	7606	1.40E+32	3.38E+29	4.12	1.82	1.56
pcb3038	3588	46560	2.00E+06	1.55E+02	3.98	1.22	1.17
nemspmm2	949	6478	2.61E+222	Inf	3.72	1.55	1.36
fome12	12652	35969	8.93E+05	4.65E+01	2.69	5.44	4.74
nl	890	2919	5.83E+293	Inf	2.62	4.09	3.34
scfxm1-2r-64	1870	11122	8.23E+11	2.84E+08	2.28	5.91	5.35
fnl4461	5044	46977	4.12E+06	2.35E+02	2.27	3.26	2.87
152	180	2659	3.59E+17	2.04E+19	2.09	0.66	0.50
d18512	10815	55880	8.61E+05	2.09E+02	1.77	9.57	8.41
rl11849	6769	40885	1.21E+08	1.92E+02	1.75	5.34	4.65
nemspmm1	982	5023	4.94E+23	1.59E+20	1.75	2.20	2.01
co5	928	6173	3.86E+185	Inf	1.69	3.78	3.46
pla7397	5059	42683	8.55E+06	3.36E+02	1.58	4.01	3.57
model6	790	3425	5.17E+63	4.11E+61	1.56	2.30	2.12
258	200	40000	1.84E+14	5.36E-01	1.54	***4.96**	***4.49**
rail4284	2463	11802	3.58E+04	7.23E+00	1.45	0.88	0.74
pilot.we	554	2367	5.11E+137	4.03E+133	1.43	3.02	2.73
342	10001	49999	4.17E+18	5.00E+03	1.39	**SF**	**SF**
qap10	1510	6381	4.45E+06	6.13E+00	1.30	0.45	0.29
cq9	1187	5786	4.94E+165	Inf	1.30	4.77	4.31
ge	1675	4758	3.29E+130	7.56E+127	1.26	8.59	7.28
de080285	368	1493	1.06E+78	1.36E+79	1.24	2.08	1.55
dano3mip.pre	1091	5239	3.46E+10	1.36E+05	1.05	0.87	0.55
dano3mip	1135	5390	2.47E+10	1.36E+05	0.99	0.78	0.60
238	200	40000	3.00E+20	6.46E+00	0.94	7.94	7.79
newman	334	2156	6.20E+233	Inf	0.93	1.82	1.44
230	200	40000	5.72E+19	8.11E-01	0.86	***8.79**	***8.79**
rat1	452	2893	3.93E+27	2.26E+30	0.85	1.15	0.89
254	200	40000	1.83E+20	2.99E+00	0.81	***10.55**	***9.39**
t0331-4l	520	5034	2.75E+04	1.10E+01	0.77	0.72	0.35
rl5915	3853	28829	3.43E+06	1.03E+02	0.77	4.62	4.65
nesm	279	895	1.01E+127	1.12E+125	0.68	4.43	3.21
grow22	434	4711	2.09E+17	4.39E+16	0.68	2.28	1.98
fome11	6226	17749	6.31E+05	5.09E+01	0.65	5.73	5.77
234	200	40000	3.18E+18	3.23E+00	0.64	***11.86**	***11.54**

						Relative Run Time	
Matrix Name	n	nnz	Cond	Norm	SPEX time (s)	Wiedemann	Lanczos
model9	902	4361	3.90E+23	6.53E+20	0.63	4.69	3.28
model7	646	2850	2.89E+137	2.87E+134	0.61	3.98	3.20
rl5934	3773	23917	2.94E+06	1.11E+02	0.60	4.77	4.48
model5	492	2247	7.35E+109	1.03E+108	0.57	4.24	3.46
orna1	810	2842	2.66E+13	2.55E+15	0.57	4.06	3.45
lp22.pre	1811	13146	3.89E+05	1.27E+01	0.56	1.93	1.77
132	216	812	8.10E+14	1.39E+00	0.55	1.35	0.94
179	430	1544	7.36E+26	2.00E+06	0.54	4.49	4.05
169	430	1544	6.57E+15	2.00E+06	0.54	4.37	4.14
168	430	1544	3.20E+15	2.00E+06	0.53	4.48	4.20
167	430	1544	1.91E+16	2.00E+06	0.53	4.55	4.16
164	430	1544	3.56E+16	2.00E+06	0.53	5.52	4.24
163	430	1544	1.90E+20	2.00E+06	0.53	4.78	4.23
176	430	1544	1.00E+15	2.00E+06	0.53	5.03	4.23
siena1	1265	11573	6.40E+05	7.85E+02	0.52	2.12	1.03
model4	409	1898	9.08E+213	NaN	0.52	3.78	3.11
165	430	1544	2.49E+14	2.00E+06	0.52	4.60	4.29
166	430	1544	2.22E+14	2.00E+06	0.51	4.66	4.45
188	430	1544	5.30E+18	2.00E+06	0.51	5.05	4.37
177	430	1544	3.78E+26	2.00E+06	0.51	5.16	4.40
194	430	1544	3.20E+19	2.00E+06	0.51	5.07	4.54
180	430	1544	9.05E+19	2.00E+06	0.51	4.92	4.45
184	430	1544	2.88E+17	2.00E+06	0.50	4.97	4.42
182	430	1544	2.88E+17	2.00E+06	0.50	5.06	4.41
186	430	1544	2.88E+17	2.00E+06	0.50	4.87	4.44
187	430	1544	2.88E+17	2.00E+06	0.50	5.04	4.43
196	430	1544	8.14E+19	2.00E+06	0.50	5.14	4.47
185	430	1544	2.88E+17	2.00E+06	0.50	4.87	4.47
202	430	1544	8.00E+19	2.00E+06	0.50	5.12	4.44
204	430	1544	7.96E+19	2.00E+06	0.50	5.01	4.50
205	430	1544	8.08E+19	2.00E+06	0.49	4.84	4.48
197	430	1544	1.15E+20	2.00E+06	0.49	5.06	4.51
203	430	1544	7.92E+19	2.00E+06	0.49	5.04	4.57
175	430	1544	4.81E+14	2.00E+06	0.49	5.04	4.55
189	430	1544	2.34E+20	2.00E+06	0.49	5.20	4.54
181	430	1544	2.88E+17	2.00E+06	0.49	5.30	4.69
de063155	313	1233	1.09E+95	6.12E+69	0.48	4.07	3.18
190	430	1544	2.31E+20	2.00E+06	0.48	5.15	4.61
192	430	1544	4.12E+20	2.00E+06	0.48	5.31	4.62
193	430	1544	2.35E+20	2.00E+06	0.48	5.28	4.62
191	430	1544	4.43E+20	2.00E+06	0.48	5.25	4.59
195	430	1544	4.66E+20	2.00E+06	0.48	5.30	4.79
172	430	1544	2.28E+19	2.00E+06	0.48	5.15	4.62
198	430	1544	8.24E+19	2.00E+06	0.48	5.37	4.68

						Relative Run Time	
Matrix Name	n	nnz	Cond	Norm	SPEX time (s)	Wiedemann	Lanczos
183	430	1544	2.88E+17	2.00E+06	0.48	5.36	4.74
170	430	1544	2.93E+14	2.00E+06	0.48	5.15	4.67
199	430	1544	8.03E+19	2.00E+06	0.47	5.36	4.73
200	430	1544	7.86E+19	2.00E+06	0.47	5.23	4.71
201	430	1544	8.03E+19	2.00E+06	0.47	5.21	4.71
173	430	1544	7.05E+19	2.00E+06	0.46	5.31	4.82
171	430	1544	6.24E+15	2.00E+06	0.46	5.77	4.86
280	430	1544	2.91E+13	2.00E+06	0.46	5.51	4.57
178	430	1544	2.17E+26	2.00E+06	0.46	5.61	4.93
174	430	1544	2.33E+14	2.00E+06	0.46	5.36	4.91
van	7417	21681	4.24E+04	7.23E+00	0.45	9.41	7.86
scfxm1-2r-32	1447	5658	2.93E+11	2.84E+08	0.45	8.52	7.46
lp22	1796	13076	1.32E+05	1.29E+01	0.42	3.11	2.45
281	430	1544	8.60E+13	2.00E+06	0.42	5.78	4.99
206	430	1544	8.02E+19	2.00E+06	0.41	6.00	5.44
161	261	1500	1.17E+15	1.04E+03	0.39	3.88	2.29
262	200	40000	6.36E+20	4.47E-01	0.38	***19.86**	***18.88**
stocfor3	1782	4562	2.03E+31	3.50E+27	0.37	20.56	17.77
arki001	160	893	4.46E+299	Inf	0.34	6.07	5.10
momentum1	932	2792	1.18E+146	2.49E+141	0.34	9.83	8.78
usa13509	3595	19919	2.89E+08	1.70E+02	0.34	10.07	8.84
large000	823	2282	1.39E+31	1.02E+34	0.33	14.58	13.28
dfl001	3271	9276	4.54E+05	4.33E+01	0.28	4.20	3.48
277	183	1069	2.69E+13	1.15E+09	0.28	***2.47**	***1.44**
complex	327	10738	9.05E+04	5.39E+01	0.26	1.54	0.70
grow15	297	3614	1.65E+13	4.24E+16	0.25	4.03	2.82
de063157	282	1102	1.10E+97	6.45E+77	0.24	7.11	5.34
t1717	549	3657	1.89E+04	7.40E+00	0.24	1.55	0.48
greenbeb	713	3278	1.17E+25	9.16E+21	0.24	7.42	6.31
dfl001.pre	2097	6501	4.10E+05	3.99E+01	0.24	2.86	2.02
scfxm1-2r-27	1222	4753	5.08E+10	2.84E+08	0.23	13.51	10.82
ulevimin	697	1879	8.89E+103	5.41E+96	0.22	8.97	7.26
pcb3000	3058	27446	5.01E+04	6.24E+01	0.21	7.81	7.44
stair	324	3431	1.27E+19	4.02E+15	0.19	2.99	1.98
newman3	369	3662	1.58E+23	3.91E+19	0.18	4.03	3.11
stp3d	10642	25936	4.12E+05	4.28E+00	0.18	36.40	31.20
nemsemm2	789	2440	1.78E+124	1.79E+123	0.18	17.00	14.18
trento1	1070	10010	1.54E+05	6.57E+02	0.18	2.77	1.51
cr42	304	608	1.52E+35	1.86E+84	0.17	24.88	23.23
car4	122	4384	1.30E+14	4.51E+15	0.15	4.24	2.45
nug08	732	3004	2.49E+05	5.71E+00	0.14	2.66	0.46
greenbea	664	2706	2.17E+38	2.38E+32	0.14	9.91	8.49
cq5	570	2615	1.05E+164	Inf	0.13	12.16	9.62
dc1l	851	5171	1.68E+05	9.70E+02	0.13	4.29	1.30

						Relative Run Time	
Matrix Name	n	nnz	Cond	Norm	SPEX time (s)	Wiedemann	Lanczos
pldd000b	537	1448	9.92E+18	1.27E+22	0.12	14.54	10.57
watson_2	1011	2703	7.02E+42	1.78E+40	0.11	19.40	16.26
25fv47	416	2061	1.42E+35	7.33E+32	0.11	7.98	5.00
237	100	10000	1.26E+19	6.46E+00	0.10	12.46	9.43
gran	284	1958	7.38E+32	1.25E+27	0.10	9.30	6.60
delf000	593	1606	1.27E+18	1.44E+20	0.10	18.79	16.49
ds	647	12193	1.01E+04	2.08E+01	0.10	5.62	3.50

Table 3: Comprehensive Results: Small Instances

						Relative Run Time	
Matrix Name	n	nnz	Cond	Norm	SPEX time (ms)	Wiedemann	Lanczos
scfxm1-2r-16	752	2962	1.94E+10	2.84E+08	9.41	14.26	10.81
dolom1	806	5681	3.47E+05	2.27E+03	9.25	7.08	1.43
dc1c	808	4698	1.26E+06	9.63E+02	9.05	5.48	1.55
dg012142	892	3627	9.32E+07	2.13E+04	9.02	9.05	5.38
scfxm1-2b-16	784	2975	3.37E+10	2.84E+08	9.00	14.52	11.49
279	261	2319	7.54E+16	2.03E+04	8.81	13.00	10.74
233	100	10000	2.98E+18	3.23E+00	8.73	12.51	11.48
257	100	10000	2.48E+14	5.36E-01	8.36	***13.03**	***11.51**
pf2177	406	1772	9.40E+03	4.65E+00	8.25	4.19	0.53
253	100	10000	3.95E+19	2.99E+00	8.18	***15.20**	***11.84**
229	100	10000	6.28E+19	8.11E-01	8.10	***13.69**	***11.49**
143	131	536	1.49E+15	9.77E+09	7.06	7.22	2.73
261	100	10000	1.04E+20	4.47E-01	6.12	***19.19**	***14.65**
ch	393	1304	4.36E+110	3.12E+106	6.05	21.43	17.07
aa01	630	4187	1.29E+04	8.67E+00	5.96	7.46	1.42
139	131	536	1.49E+15	9.77E+09	5.63	8.76	3.43
air04	630	4187	1.29E+04	8.67E+00	5.48	6.20	1.56
stormg2-125	1886	4372	2.63E+07	2.26E+03	5.41	41.10	36.68
model3	310	1417	3.11E+95	6.44E+93	5.33	11.84	7.72
stormg2-125.pre	1780	4138	1.96E+09	5.43E+04	4.91	45.32	36.03
msc98-ip	2897	10006	1.63E+07	4.26E+02	4.72	41.80	37.10
df2177	414	1825	4.61E+03	4.74E+00	4.32	6.32	3.06
nug07	450	1780	5.45E+04	5.28E+00	4.09	4.86	3.13
biella1	813	5726	2.72E+04	1.18E+01	3.83	11.68	4.52
pcb1000	1156	9955	2.28E+04	4.37E+01	3.62	9.28	6.30
aa03	562	3420	1.07E+04	9.00E+00	3.56	9.70	1.42
protfold	574	2562	8.36E+03	6.50E+00	3.42	10.66	1.67
pds-100	8377	17555	1.79E+04	5.48E+00	3.38	121.91	114.99
rosen10	989	6916	2.01E+03	1.35E+03	3.34	40.93	17.40
lpl1	2692	7211	8.18E+08	1.02E+04	3.31	76.13	30.93
grow7	138	1744	8.45E+12	3.53E+16	3.29	11.67	5.16

						Relative Run Time	
Matrix Name	n	nnz	Cond	Norm	SPEX time (ms)	Wiedemann	Lanczos
air06	562	3420	1.07E+04	9.00E+00	3.13	7.97	1.60
pds-80	9225	19432	1.12E+04	5.66E+00	2.88	195.69	166.12
pds-90	7914	16673	1.48E+04	4.13E+00	2.84	144.91	129.57
pds-70	7822	16545	1.11E+04	5.84E+00	2.76	155.28	134.17
model2	149	757	1.15E+112	4.60E+108	2.74	27.60	6.74
l9	241	1381	7.65E+21	1.74E+19	2.68	14.93	7.46
pds-60	7586	16067	8.18E+03	4.48E+00	2.61	133.01	122.99
degen3	744	5431	1.66E+04	2.00E+01	2.48	14.50	3.15
bg512142	560	2140	6.92E+06	1.95E+03	2.21	21.17	8.41
scfxm1-2r-8	403	1608	7.45E+09	2.84E+08	2.01	24.88	14.95
bas1lp	502	6651	9.77E+04	9.80E+01	1.95	23.29	6.54
gosh	379	1379	8.05E+27	4.51E+24	1.90	38.08	20.26
pilot4i	134	1220	1.50E+33	4.19E+28	1.88	20.85	8.11
rosen2	431	4143	7.85E+02	3.19E+02	1.86	46.94	9.46
pds-50	5962	12592	1.04E+04	3.49E+00	1.83	100.82	95.64
rail507	413	2005	5.39E+03	6.85E+00	1.48	21.31	7.85
scsd8	247	655	9.59E+18	1.58E+17	1.40	32.29	16.27
air05	323	1789	2.79E+04	6.94E+00	1.40	13.34	3.16
30_70_4.5_0.95_100	2754	8381	6.12E+03	4.34E+00	1.38	70.03	54.02
d6cube	223	1424	9.56E+05	4.24E+02	1.38	4.18	8.83
mitre	801	2466	4.18E+05	2.81E+03	1.28	71.92	37.51
fome21	3291	7240	9.21E+03	3.18E+00	1.24	70.06	50.55
modszk1	263	765	1.52E+21	1.25E+20	1.23	92.27	15.12
10teams	177	885	1.12E+03	5.63E+00	1.17	9.16	4.62
pds-40	4028	8478	6.64E+03	3.02E+00	1.14	84.03	54.20
fast0507	401	1908	3.72E+03	6.99E+00	1.13	22.27	5.28
south31	112	460	1.68E+265	Inf	1.10	90.21	12.86
qiulp	603	1717	8.25E+10	1.31E+09	1.09	32.35	16.01
qiu	603	1717	5.99E+10	1.31E+09	1.09	55.15	16.11
ganges	344	1123	4.19E+26	3.03E+25	1.09	47.32	23.96
cycle	284	878	1.46E+79	3.19E+75	1.06	47.12	19.64
maros	289	1143	2.76E+14	2.54E+11	0.97	39.30	11.16
30_70_4.5_0.95_98	2451	7364	7.84E+03	4.35E+00	0.94	90.63	61.09
scagr7-2r-864	680	1697	6.99E+06	3.42E+03	0.84	87.19	44.41
p05	919	2717	4.06E+04	3.06E+01	0.82	58.18	14.21
rentacar	327	1080	3.64E+05	1.01E+03	0.81	38.50	49.30
bnl2	459	1488	1.22E+15	1.10E+12	0.81	87.01	32.92
30_70_4.5_0.5_100	2098	6197	1.98E+03	4.28E+00	0.75	88.59	54.45
pds-30	2643	5641	3.27E+03	3.04E+00	0.74	95.40	51.03
bandm	122	609	1.12E+27	1.05E+26	0.74	45.42	9.74
r05	919	2717	4.06E+04	3.06E+01	0.73	39.90	16.78
fome20	1718	3811	5.39E+03	3.14E+00	0.67	68.02	29.74
scfxm1-2b-4	233	965	5.92E+09	2.84E+08	0.66	49.39	14.98
scfxm1-2r-4	233	965	5.92E+09	2.84E+08	0.66	87.60	14.92

						Relative Run Time	
Matrix Name	n	nnz	Cond	Norm	SPEX time (ms)	Wiedemann	Lanczos
scfxm1-2c-4	233	965	5.92E+09	2.84E+08	0.66	51.71	15.03
baxter.pre	470	1274	3.55E+94	8.48E+88	0.64	94.20	41.38
nug06	267	1007	1.04E+04	4.81E+00	0.57	8.39	10.57
neos	2342	5098	3.29E+04	5.88E+00	0.56	110.87	46.57
capri	138	507	3.72E+68	3.01E+65	0.54	79.61	23.11
rail582	384	1387	4.55E+03	5.10E+00	0.53	22.83	22.75
danoint	196	790	2.11E+07	6.31E+03	0.53	45.87	5.47
neos.pre	2080	4578	1.60E+04	5.86E+00	0.48	161.55	45.24
p010	839	2486	3.96E+04	3.06E+01	0.48	81.81	21.01
rosen1	217	2528	1.23E+03	5.80E+02	0.48	65.13	11.27
rosen8	264	1850	2.53E+02	8.87E+01	0.47	88.81	10.78
seymour	537	1881	5.24E+03	5.81E+00	0.44	77.87	8.98
bnl1	223	824	3.34E+23	2.35E+20	0.44	135.85	25.00
mzzv11	1098	3189	8.92E+05	2.46E+02	0.42	83.45	39.75
scfxm3	262	1005	1.67E+17	7.58E+13	0.42	85.35	29.35
scrs8-2r-512	992	1984	1.92E+01	9.13E+00	0.38	114.47	51.21
rail516	268	936	1.31E+03	5.64E+00	0.37	15.38	20.34
sp97ar	271	2400	2.40E+04	3.93E+01	0.37	126.44	37.75
neos7	590	1434	1.46E+08	1.00E+06	0.34	234.47	53.01
stocfor2	224	576	3.54E+26	1.50E+24	0.33	174.61	36.69
dbir1	154	845	4.54E+06	1.42E+06	0.32	180.07	24.27
small000	140	383	6.77E+19	5.59E+23	0.32	122.40	31.55
neos6	174	1580	3.33E+03	7.20E+01	0.32	25.32	30.72
sp98ar	223	1782	1.69E+04	4.43E+01	0.31	59.23	62.01
woodw	168	589	1.44E+12	3.80E+10	0.29	282.23	27.99
80bau3b	154	396	3.31E+46	1.75E+45	0.29	146.51	35.63
manna81	1392	2784	3.00E+00	2.00E+00	0.29	119.16	34.38
roll3000	177	1101	2.19E+06	1.47E+03	0.28	47.75	23.19
disctom	192	565	5.92E+02	3.41E+00	0.28	11.65	14.21
dbir2.pre	281	1879	5.86E+06	1.10E+05	0.28	151.55	17.77
scfxm2	178	658	1.67E+17	7.58E+13	0.27	87.07	20.94
neos11	365	1116	3.06E+03	5.06E+00	0.26	40.09	64.46
mzzv42z	787	2124	5.68E+05	2.01E+02	0.26	103.11	33.88
route	339	1290	7.27E+08	2.03E+07	0.26	95.47	38.07
degen2	217	1138	2.58E+03	1.15E+01	0.25	11.23	31.76
dsbmip	220	568	3.06E+46	2.19E+41	0.24	191.73	31.08
nsct1	120	595	4.25E+06	7.67E+05	0.23	257.58	270.62
stormg2-27	449	1019	3.67E+06	1.77E+03	0.23	311.75	40.18
baxter	256	697	3.06E+21	6.81E+15	0.23	201.24	30.85
neos1	309	944	8.24E+02	4.83E+00	0.22	13.85	9.92
crew1	127	861	7.82E+02	8.18E+00	0.22	3.32	4.40
blp-ar98	148	876	3.94E+03	9.40E+01	0.18	33.94	77.04
nsct2.pre	156	1140	3.84E+06	3.22E+05	0.16	106.01	127.32
sgpf5y6	787	1870	6.24E+02	3.37E+00	0.15	146.43	83.92

						Relative Run Time	
Matrix Name	n	nnz	Cond	Norm	SPEX time (ms)	Wiedemann	Lanczos
pds-20.pre	370	851	1.07E+03	3.38E+00	0.13	51.60	61.08
sgpf5y6.pre	755	1744	1.20E+02	3.22E+00	0.12	295.60	56.57
p19	117	555	4.13E+05	4.37E+04	0.12	156.17	98.19
iiasa	113	262	6.06E+18	6.37E+17	0.12	304.00	46.43
scrs8-2r-256	416	832	1.92E+01	9.13E+00	0.12	214.69	32.78
UMTS	268	828	4.40E+20	3.24E+18	0.11	100.90	103.26
neos818918	265	678	4.29E+02	3.22E+00	0.10	30.12	24.17
rd-rplusc-21	148	454	7.35E+16	4.38E+13	0.10	237.73	239.83
neos4	454	944	2.63E+08	5.59E+06	0.10	176.16	225.01
rosen7	127	649	8.23E+01	5.75E+01	0.10	45.33	155.96
ceria3d	130	647	2.40E+04	1.09E+01	0.10	19.26	32.27
dbir2	157	784	1.71E+06	7.27E+04	0.10	41.07	78.17
scrs8-2r-64	256	512	1.60E+05	1.41E+05	0.10	263.03	68.37
boeing1	122	415	7.36E+10	6.29E+07	0.09	134.16	136.24
scrs8	109	280	2.97E+27	8.93E+24	0.09	233.86	124.79
gesa3_o	148	365	1.73E+29	1.19E+26	0.09	457.90	48.61
neos19	228	487	7.19E+04	5.23E+01	0.09	49.19	126.88
pp08aCUTS	131	332	1.44E+04	4.27E+02	0.08	65.16	41.73
scorpion	131	507	7.19E+06	2.00E+05	0.08	119.88	332.56
gesa3	134	336	1.73E+29	1.19E+26	0.08	169.82	183.58
neos823206	220	547	3.15E+05	2.24E+03	0.08	129.95	97.29
sc205	184	487	1.18E+04	2.10E+01	0.08	105.17	103.36
nsct2	107	544	2.74E+06	2.40E+05	0.07	34.50	48.16
nug05	107	362	1.14E+03	4.15E+00	0.06	5.64	9.54
lpl3	212	461	3.06E+02	2.61E+00	0.06	84.57	80.55
scrs8-2r-128	192	384	1.92E+01	9.13E+00	0.06	35.22	42.63
scrs8-2c-64	168	336	4.80E+01	2.66E+01	0.06	75.68	94.17
stormg2-8	117	263	4.82E+05	1.77E+03	0.05	96.96	70.89
dcmulti	120	303	7.03E+03	6.26E+02	0.05	92.34	80.35
mkc1	106	250	1.27E+06	2.89E+04	0.05	25.26	32.34
mkc	106	250	1.27E+06	2.89E+04	0.04	26.44	12.39
gesa2_o	102	214	6.47E+09	4.13E+08	0.04	110.27	465.18
scrs8-2r-32	128	256	4.16E+01	3.54E+01	0.04	85.14	90.84
bienst1	102	253	7.61E+02	6.09E+00	0.03	11.11	16.36

Table 4: Comprehensive Results: Tiny Instances