

Planning for Temporally Extended Goals in Pure-Past Linear Temporal Logic: A Polynomial Reduction to Standard Planning

Supplementary Material for Paper #259

1 Experimental results.

For better readability, we show the plots of experimental results in larger size and detailed running time.

The source code of our implementation and the datasets used will be publicly available on GitHub, upon acceptance of the paper.

2 BLOCKSWORLD, deterministic, experiment 1

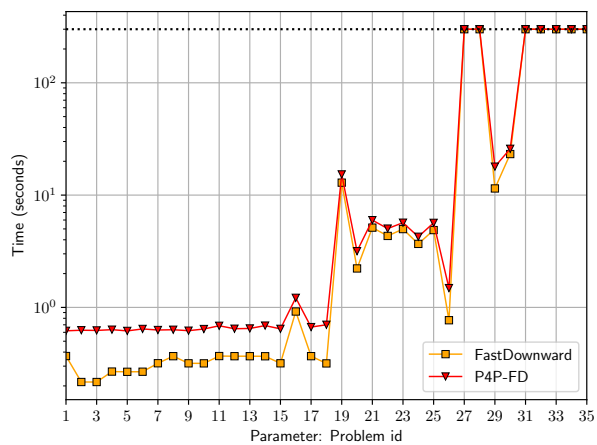


Figure 1: BLOCKSWORLD deterministic, experiment 1 (only first 35 instances).

Benchmark name	FastDownward	P4P + FD
p-001	0.37	0.62
p-002	0.22	0.63
p-003	0.22	0.62
p-004	0.27	0.63
p-005	0.27	0.62
p-006	0.27	0.64
p-007	0.32	0.63
p-008	0.37	0.63
p-009	0.32	0.62
p-010	0.32	0.64
p-011	0.37	0.69
p-012	0.37	0.65
p-013	0.37	0.65
p-014	0.37	0.69
p-015	0.32	0.64
p-016	0.92	1.22
p-017	0.37	0.67
p-018	0.32	0.70
p-019	12.91	15.28
p-020	2.22	3.17
p-021	5.13	5.98
p-022	4.33	5.03
p-023	4.98	5.68
p-024	3.68	4.26
p-025	4.88	5.66
p-026	0.77	1.49
p-027	—	—
p-028	—	—
p-029	11.46	17.92
p-030	23.20	25.84

Table 1: BLOCKSWORLD deterministic, experiment 1. Reachability vs PPLTL goal. Running times. Entries from p30 on are all timed out.

Benchmark name	FastDownward	P4P + FD
p-001	7	7
p-002	13	12
p-003	10	10
p-004	26	25
p-005	26	22
p-006	50	51
p-007	18	18
p-008	13	13
p-009	438	407
p-010	130	105
p-011	1833	1831
p-012	340	337
p-013	318	312
p-014	1685	1686
p-015	110	112
p-016	21605	21299
p-017	719	689
p-018	1286	1331
p-019	466343	471639
p-020	59573	58944
p-021	159521	159383
p-022	118601	118602
p-023	124730	124649
p-024	101979	101977
p-025	111332	111331
p-026	13629	13633
p-027	—	—
p-028	—	—
p-029	201350	201347
p-030	372538	372525

Table 2: BLOCKSWORLD deterministic, experiment 1. Reachability vs PPLTL goal. Expanded nodes. Entries from p30 on are all timed out.

3 BLOCKSWORLD, deterministic, experiment 2a

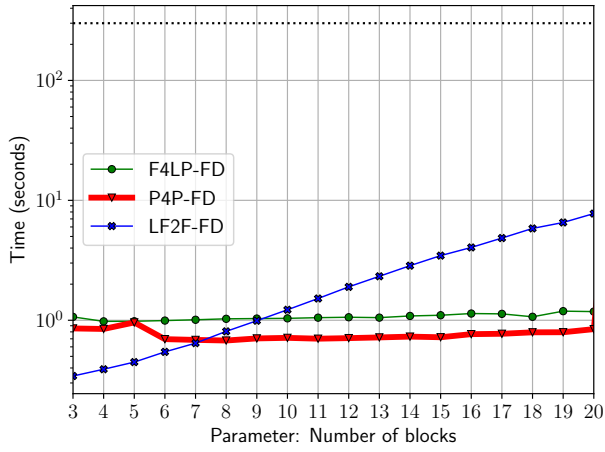


Figure 2: BLOCKSWORLD deterministic, experiment 2a.

Benchmark name	P4P-FD	F4LP-FD	LF2F-FD
p03	0.85	1.07	0.34
p04	0.85	0.98	0.39
p05	0.96	0.98	0.45
p06	0.70	0.99	0.54
p07	0.69	1.01	0.64
p08	0.68	1.03	0.81
p09	0.71	1.03	0.99
p10	0.71	1.04	1.22
p11	0.70	1.05	1.52
p12	0.71	1.06	1.90
p13	0.72	1.05	2.33
p14	0.73	1.09	2.85
p15	0.72	1.10	3.46
p16	0.77	1.14	4.05
p17	0.77	1.13	4.85
p18	0.79	1.07	5.83
p19	0.79	1.19	6.54
p20	0.84	1.18	7.76

Table 3: BLOCKSWORLD deterministic running times, experiment 2a.

Benchmark name	P4P-FD	F4LP-FD	LF2F-FD
p03	6	11	10
p04	6	11	8
p05	6	11	8
p06	6	11	8
p07	6	11	8
p08	6	11	8
p09	6	11	8
p10	6	11	7
p11	6	11	7
p12	6	11	7
p13	6	11	7
p14	6	11	7
p15	6	11	7
p16	6	11	7
p17	6	11	7
p18	6	11	7
p19	6	11	7
p20	6	11	7

Table 4: BLOCKSWORLD deterministic number of expanded nodes, experiment 2a.

4 BLOCKSWORLD, deterministic, experiment 2b

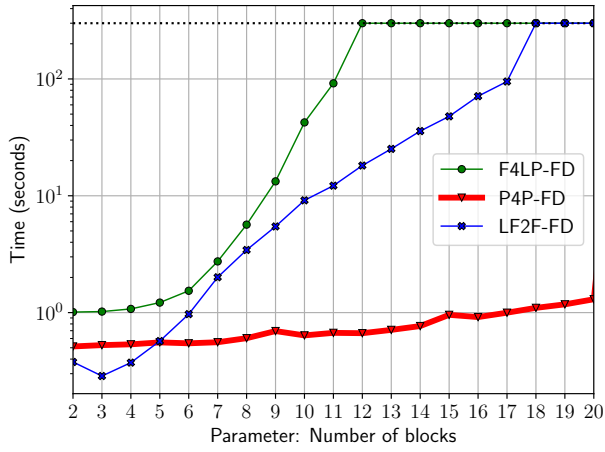


Figure 3: BLOCKSWORLD deterministic, experiment 2b.

Benchmark name	P4P-FD	F4LP-FD	LF2F-FD
p02	0.51	1.01	0.38
p03	0.53	1.02	0.29
p04	0.54	1.08	0.37
p05	0.56	1.22	0.57
p06	0.55	1.54	0.97
p07	0.56	2.74	2.01
p08	0.60	5.66	3.44
p09	0.69	13.29	5.46
p10	0.64	42.46	9.14
p11	0.67	91.74	12.20
p12	0.67	—	18.15
p13	0.71	—	25.20
p14	0.77	—	35.79
p15	0.96	—	47.84
p16	0.92	—	71.17
p17	1.00	—	95.05
p18	1.10	—	—
p19	1.18	—	—
p20	1.30	—	—

Table 5: BLOCKSWORLD, deterministic, experiment 2b.
Running times.

Benchmark name	P4P-FD	F4LP-FD	LF2F-FD
p02	3	5	5
p03	6	11	10
p04	13	23	15
p05	21	57	24
p06	31	158	34
p07	43	584	46
p08	57	1671	60
p09	73	5346	76
p10	90	19221	85
p11	95	91531	112
p12	101	—	135
p13	109	—	160
p14	119	—	186
p15	131	—	214
p16	145	—	244
p17	161	—	276
p18	179	—	—
p19	199	—	—
p20	221	—	—

Table 6: BLOCKSWORLD, deterministic, experiment 2b.
Number of expanded nodes.

5 ELEVATOR, experiment 1

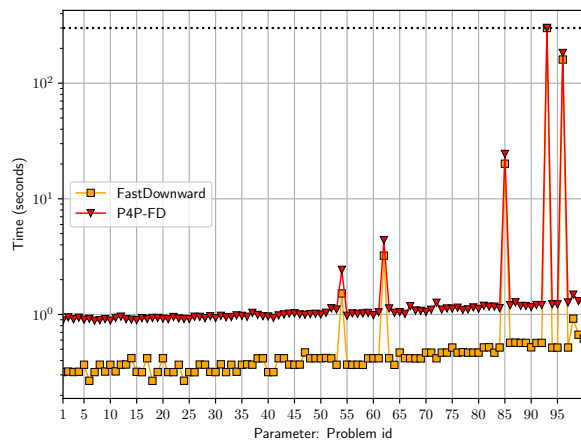


Figure 4: ELEVATOR, experiment 1 (only first 100 instances)

Benchmark name	FD	P4P-FD
p-001	0.32	0.89
p-002	0.32	0.94
p-003	0.32	0.91
p-004	0.32	0.94
p-005	0.37	0.90
p-006	0.27	0.92
p-007	0.32	0.88
p-008	0.37	0.89
p-009	0.32	0.91
p-010	0.37	0.88
p-011	0.32	0.93
p-012	0.37	0.96
p-013	0.37	0.91
p-014	0.42	0.90
p-015	0.32	0.89
p-016	0.32	0.93
p-017	0.42	0.91
p-018	0.27	0.93
p-019	0.32	0.93
p-020	0.42	0.92
p-021	0.32	0.91
p-022	0.32	0.95
p-023	0.37	0.92
p-024	0.27	0.91
p-025	0.32	0.91
p-026	0.32	0.96
p-027	0.37	0.95
p-028	0.37	0.93
p-029	0.32	0.96
p-030	0.32	0.93
p-031	0.37	0.97
p-032	0.32	0.95
p-033	0.37	0.95
p-034	0.32	0.98
p-035	0.37	0.97
p-036	0.37	0.96
p-037	0.37	1.03
p-038	0.42	0.99
p-039	0.42	0.97
p-040	0.32	0.96
p-041	0.32	0.93
p-042	0.42	0.98
p-043	0.42	1.00
p-044	0.37	1.02
p-045	0.37	1.02
p-046	0.37	1.00
p-047	0.47	0.99
p-048	0.42	1.01
p-049	0.42	1.01
p-050	0.42	1.00
p-051	0.42	1.03
p-052	0.42	1.13
p-053	0.37	1.10
p-054	1.52	2.43
p-055	0.37	0.97
p-056	0.37	1.02
p-057	0.37	1.01
p-058	0.37	1.02
p-059	0.42	1.03
p-060	0.42	0.99
p-061	0.42	1.04
p-062	3.22	4.39
p-063	0.42	1.13
p-064	0.37	1.03
p-065	0.47	1.05
p-066	0.42	1.01
p-067	0.42	1.18
p-068	0.42	1.08
p-069	0.42	1.07
p-070	0.47	1.05
p-071	0.47	1.10
p-072	0.42	1.26
p-073	0.47	1.10
p-074	0.47	1.13
p-075	0.52	1.12

Table 7: ELEVATOR, experiment 1. Running times. Entries below are all timed out.

Benchmark name	FD	P4P-FD
p-076	0.47	1.14
p-077	0.47	1.09
p-078	0.47	1.11
p-079	0.47	1.15
p-080	0.47	1.12
p-081	0.52	1.19
p-082	0.52	1.17
p-083	0.47	1.17
p-084	0.52	1.13
p-085	20.12	24.43
p-086	0.57	1.20
p-087	0.57	1.27
p-088	0.57	1.19
p-089	0.57	1.18
p-090	0.52	1.15
p-091	0.57	1.21
p-092	0.57	1.21
p-093	—	—
p-094	0.52	1.22
p-095	0.52	1.22
p-096	160.18	182.53
p-097	0.52	1.27
p-098	0.92	1.48
p-099	0.67	1.31
p-100	0.62	1.26
p-101	0.67	1.40
p-102	0.57	1.34
p-103	0.52	1.34
p-104	0.57	1.34
p-105	0.67	1.34
p-106	0.77	1.50
p-107	0.67	1.41
p-108	0.72	1.51
p-109	0.67	1.37
p-110	0.67	1.39
p-111	0.77	1.50
p-112	—	—
p-113	0.72	1.51
p-114	—	—
p-115	0.72	1.46
p-116	0.82	1.51
p-117	0.82	1.51
p-118	0.72	1.59
p-119	0.77	1.41
p-120	0.82	1.54
p-121	0.97	1.70
p-122	1.07	1.81
p-123	—	—
p-124	0.72	1.52
p-125	0.92	1.60
p-126	0.87	1.73
p-127	—	—
p-128	0.87	1.89
p-129	1.07	2.27
p-130	0.77	1.87
p-131	—	—
p-132	0.82	1.90
p-133	1.42	2.65
p-134	0.92	2.09
p-135	1.07	2.24
p-136	0.92	2.02
p-137	—	—
p-138	0.97	2.24
p-139	1.17	2.38
p-140	1.02	2.11
p-141	0.92	2.04
p-142	1.17	2.33
p-143	1.17	2.28
p-144	1.17	2.23
p-145	1.17	2.34
p-146	1.17	2.25
p-147	1.22	2.50
p-148	1.07	2.26
p-149	—	—
p-150	1.22	2.27

Table 8: ELEVATOR, experiment 1. Running times. Entries below are all timed out.

Benchmark name	FD	P4P-FD
p-001	5	5
p-002	4	4
p-003	5	5
p-004	5	5
p-005	5	5
p-006	9	9
p-007	9	9
p-008	9	9
p-009	8	8
p-010	11	11
p-011	18	18
p-012	23	23
p-013	17	17
p-014	13	13
p-015	13	13
p-016	16	16
p-017	17	17
p-018	19	19
p-019	23	23
p-020	30	30
p-021	30	30
p-022	25	25
p-023	24	24
p-024	20	20
p-025	28	28
p-026	44	44
p-027	22	22
p-028	31	31
p-029	132	132
p-030	30	30
p-031	33	33
p-032	50	50
p-033	24	24
p-034	34	34
p-035	46	46
p-036	39	39
p-037	556	556
p-038	56	56
p-039	50	50
p-040	45	45
p-041	62	62
p-042	67	67
p-043	58	58
p-044	37	37
p-045	478	478
p-046	58	58
p-047	65	65
p-048	75	75
p-049	53	53
p-050	45	45
p-051	79	79
p-052	58	58
p-053	96	96
p-054	18048	18048
p-055	77	77
p-056	55	55
p-057	86	86
p-058	103	103
p-059	81	81
p-060	62	62
p-061	80	80
p-062	19829	19829
p-063	118	118
p-064	75	75
p-065	75	75
p-066	71	71
p-067	84	84
p-068	128	128
p-069	102	102
p-070	119	119
p-071	110	110
p-072	184	184
p-073	155	155
p-074	168	168
p-075	157	157

Table 9: ELEVATOR, experiment 1. Expanded nodes. Entries below are all timed out.

Benchmark name	FD	P4P-FD
p-076	112	112
p-077	112	112
p-078	137	137
p-079	212	212
p-080	138	138
p-081	168	168
p-082	175	175
p-083	180	180
p-084	116	116
p-085	86653	86653
p-086	183	183
p-087	214	214
p-088	188	188
p-089	166	166
p-090	145	145
p-091	203	203
p-092	217	217
p-093	—	—
p-094	207	207
p-095	161	161
p-096	496091	496091
p-097	159	159
p-098	482	482
p-099	268	268
p-100	194	194
p-101	251	251
p-102	209	209
p-103	137	137
p-104	197	197
p-105	167	167
p-106	339	339
p-107	289	289
p-108	357	357
p-109	183	183
p-110	188	188
p-111	236	236
p-112	—	—
p-113	245	245
p-114	—	—
p-115	246	246
p-116	224	224
p-117	290	290
p-118	284	284
p-119	274	274
p-120	271	271
p-121	436	436
p-122	552	552
p-123	—	—
p-124	275	275
p-125	333	333
p-126	403	403
p-127	—	—
p-128	306	306
p-129	456	456
p-130	245	245
p-131	—	—
p-132	234	234
p-133	687	687
p-134	340	340
p-135	486	486
p-136	363	363
p-137	—	—
p-138	416	416
p-139	419	419
p-140	345	345
p-141	239	239
p-142	379	379
p-143	428	428
p-144	405	405
p-145	464	464
p-146	355	355
p-147	453	453
p-148	378	378
p-149	—	—
p-150	394	394

Table 10: ELEVATOR, experiment 1. Expanded nodes. Entries below are all timed out.

6 ELEVATOR, experiment 2a

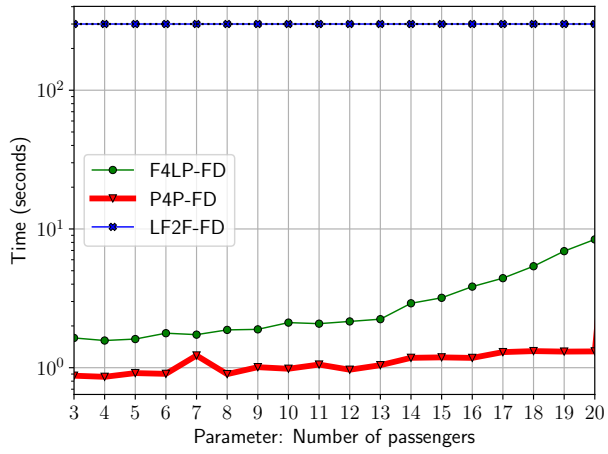


Figure 5: ELEVATOR, experiment 2a.

Benchmark name	P4P-FD	F4LP-FD	LF2F-FD
p03	0.88	1.64	—
p04	0.86	1.57	—
p05	0.91	1.61	—
p06	0.90	1.77	—
p07	1.22	1.73	—
p08	0.90	1.87	—
p09	1.01	1.89	—
p10	0.98	2.11	—
p11	1.05	2.08	—
p12	0.97	2.16	—
p13	1.04	2.24	—
p14	1.18	2.91	—
p15	1.19	3.19	—
p16	1.18	3.84	—
p17	1.30	4.42	—
p18	1.32	5.39	—
p19	1.31	6.92	—
p20	1.31	8.41	—

Table 11: ELEVATOR, experiment 2a. Running times.

Benchmark name	P4P-FD	F4LP-FD	LF2F-FD
p03	10	297	—
p04	10	609	—
p05	10	1124	—
p06	10	1908	—
p07	10	3029	—
p08	10	4557	—
p09	10	6564	—
p10	10	9124	—
p11	10	12313	—
p12	10	16209	—
p13	10	20892	—
p14	10	26444	—
p15	10	32949	—
p16	10	40493	—
p17	10	49164	—
p18	10	59052	—
p19	10	70249	—
p20	10	82849	—

Table 12: ELEVATOR, experiment 2a. Number of expanded nodes.

7 ELEVATOR, experiment 2b

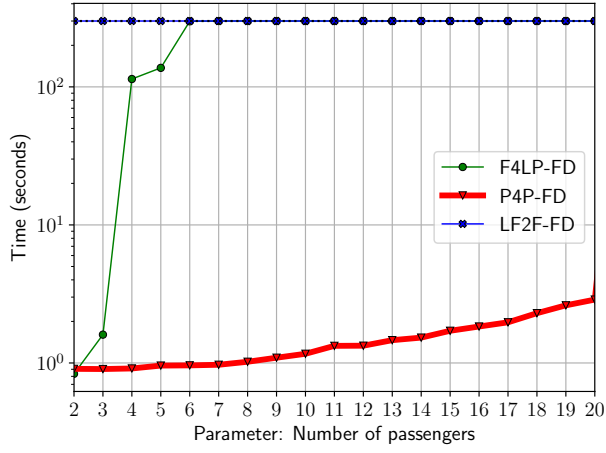


Figure 6: ELEVATOR, experiment 2b.

Benchmark name	P4P-FD	F4LP-FD	LF2F-FD
p02	0.91	0.83	0.17
p03	0.90	1.60	—
p04	0.91	114.02	—
p05	0.96	137.32	—
p06	0.96	298.57	—
p07	0.97	—	—
p08	1.02	—	—
p09	1.09	—	—
p10	1.17	—	—
p11	1.33	—	—
p12	1.33	—	—
p13	1.46	—	—
p14	1.53	—	—
p15	1.71	—	—
p16	1.84	—	—
p17	1.97	—	—
p18	2.29	—	—
p19	2.62	—	—
p20	2.88	—	—

Table 13: ELEVATOR, experiment 2b. Running times.

Benchmark name	P4P-FD	F4LP-FD	LF2F-FD
p02	7	52	—
p03	10	297	—
p04	13	1750	—
p05	16	9552	—
p06	19	51102	—
p07	22	—	—
p08	25	—	—
p09	28	—	—
p10	31	—	—
p11	34	—	—
p12	37	—	—
p13	40	—	—
p14	43	—	—
p15	46	—	—
p16	49	—	—
p17	52	—	—
p18	55	—	—
p19	58	—	—
p20	61	—	—

Table 14: ELEVATOR, experiment 2b. Number of expanded nodes.

8 BLOCKSWORLD, non-deterministic, experiment 1

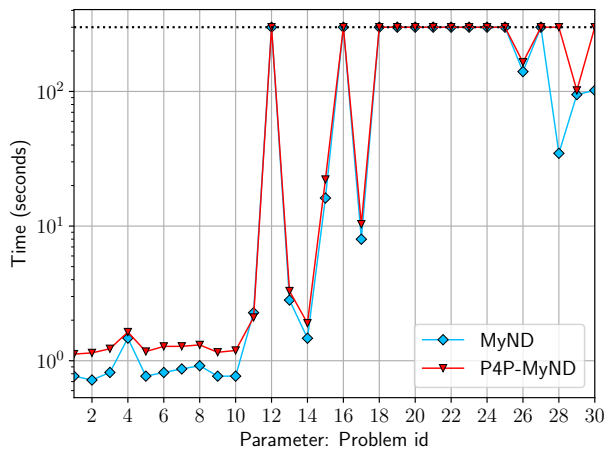


Figure 7: BLOCKSWORLD (non-deterministic), experiment 1.

Benchmark name	MyND	P4P-MyND
p01	0.77	1.12
p02	0.72	1.14
p03	0.82	1.23
p04	1.47	1.63
p05	0.77	1.17
p06	0.82	1.28
p07	0.87	1.28
p08	0.92	1.31
p09	0.77	1.16
p10	0.77	1.19
p11	2.27	2.10
p12	—	—
p13	2.82	3.29
p14	1.47	1.90
p15	16.16	22.18
p16	—	—
p17	7.99	10.33
p18	—	—
p19	—	—
p20	—	—
p21	—	—
p22	—	—
p23	—	—
p24	—	—
p25	—	—
p26	140.38	164.70
p27	—	—
p28	34.72	—
p29	94.75	101.73
p30	101.92	—

Table 15: BLOCKSWORLD, non-deterministic, experiment 1. Reachability vs PPLTL goal. Running times.

Benchmark name	MyND	P4P-MyND
p01	12	12
p02	8	8
p03	10	10
p04	200	200
p05	16	16
p06	31	31
p07	60	60
p08	57	57
p09	8	8
p10	10	10
p11	75	75
p12	—	—
p13	216	216
p14	29	29
p15	1068	1104
p16	—	—
p17	682	682
p18	—	—
p19	—	—
p20	—	—
p21	—	—
p22	—	—
p23	—	—
p24	—	—
p25	—	—
p26	2330	2316
p27	—	—
p28	1036	—
p29	1872	1872
p30	1888	—

Table 16: BLOCKSWORLD, non-deterministic, experiment 1. Reachability vs PPLTL goal. Expanded nodes.

9 BLOCKSWORLD, non-deterministic, experiment 2a

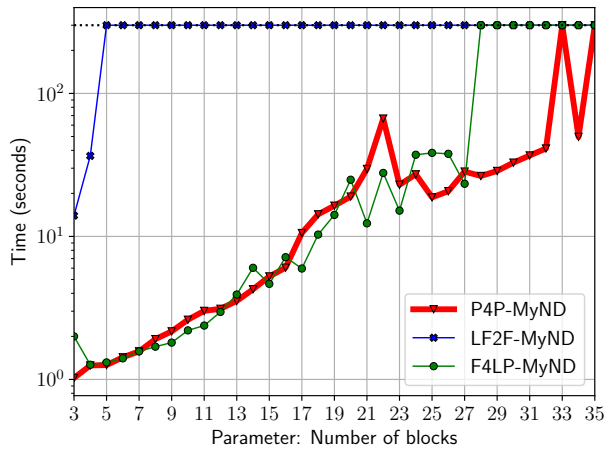


Figure 8: BLOCKSWORLD (non-deterministic), experiment 2a.

Benchmark name	P4P-MyND	F4LP-MyND	LF2F-MyND
p03	1.02	2.00	13.98
p04	1.25	1.27	36.58
p05	1.26	1.31	—
p06	1.43	1.40	—
p07	1.57	1.57	—
p08	1.91	1.69	—
p09	2.17	1.81	—
p10	2.61	2.20	—
p11	3.02	2.38	—
p12	3.12	2.97	—
p13	3.54	3.92	—
p14	4.27	6.03	—
p15	5.25	4.66	—
p16	6.05	7.16	—
p17	10.56	5.97	—
p18	14.27	10.30	—
p19	16.41	14.14	—
p20	18.99	24.91	—
p21	29.64	12.35	—
p22	66.72	27.79	—
p23	22.97	15.15	—
p24	27.19	37.26	—
p25	18.76	38.40	—
p26	20.72	37.82	—
p27	28.41	23.35	—
p28	26.48	—	—
p29	28.70	—	—
p30	32.82	—	—
p31	36.83	—	—
p32	41.19	—	—
p33	—	—	—
p34	49.69	—	—
p35	—	—	—

Table 17: BLOCKSWORLD, non-deterministic, experiment 2a. Running times.

Benchmark name	P4P-MyND	F4LP-MyND	LF2F-MyND
p03	5	21	74
p04	5	38	62
p05	5	23	—
p06	13	21	—
p07	29	62	—
p08	41	55	—
p09	35	27	—
p10	49	23	—
p11	47	25	—
p12	5	57	—
p13	5	93	—
p14	13	179	—
p15	13	39	—
p16	13	135	—
p17	67	39	—
p18	67	129	—
p19	69	171	—
p20	67	329	—
p21	99	91	—
p22	119	201	—
p23	33	59	—
p24	33	213	—
p25	5	183	—
p26	5	149	—
p27	13	53	—
p28	5	—	—
p29	5	—	—
p30	5	—	—
p31	5	—	—
p32	5	—	—
p33	—	—	—
p34	5	—	—
p35	—	—	—

Table 18: BLOCKSWORLD, non-deterministic, experiment 2a. Number of expanded nodes.

10 BLOCKSWORLD, non-deterministic, experiment 2b

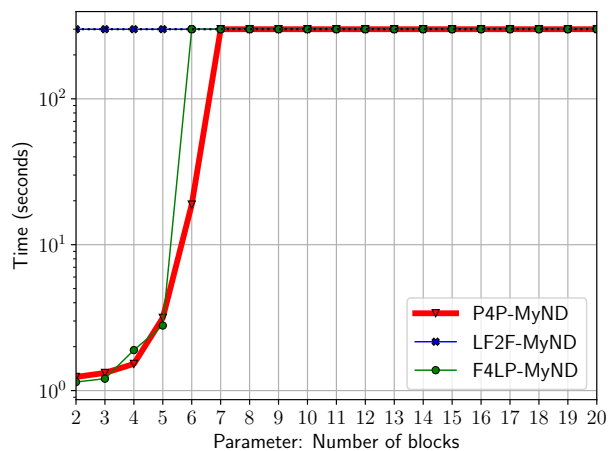


Figure 9: BLOCKSWORLD (non-deterministic), experiment 2b.

Benchmark name	P4P-MyND	F4LP-MyND	LF2F-MyND
p02	1.24	1.14	0.17
p03	1.32	1.21	—
p04	1.52	1.89	—
p05	3.15	2.79	—
p06	18.83	—	—
p07	—	—	—

Table 19: BLOCKSWORLD (non-deterministic), experiment 2b. Running times.

Benchmark name	P4P-MyND	F4LP-MyND	LF2F-MyND
p02	2	5	—
p03	5	21	—
p04	58	274	—
p05	374	500	—
p06	710	—	—
p07	—	—	—

Table 20: BLOCKSWORLD (non-deterministic), experiment 2b. Number of expanded nodes.

11 TRIANGLE-TIREWORLD, experiment 1

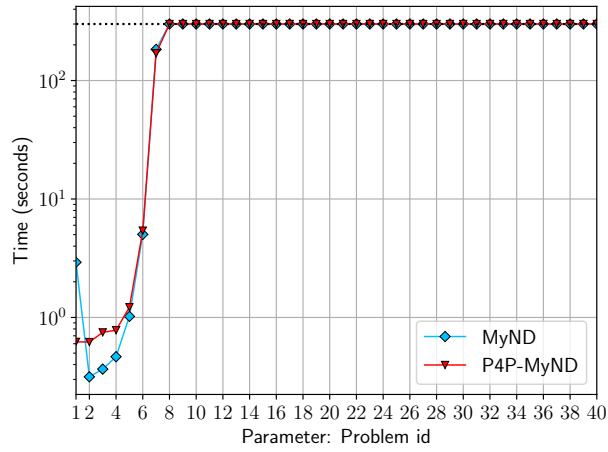


Figure 10: TRIANGLE-TIREWORLD, experiment 1

Benchmark name	MyND	P4P-MyND
p01	2.92	0.62
p02	0.32	0.62
p03	0.37	0.75
p04	0.47	0.78
p05	1.02	1.22
p06	5.03	5.41
p07	183.39	169.74
p08	—	—
p09	—	—

Table 21: TRIANGLE-TIREWORLD, experiment 1. Running times.

Benchmark name	MyND	P4P-MyND
p01	22	22
p02	61	61
p03	217	217
p04	805	805
p05	3121	3121
p06	12349	12349
p07	49225	49225
p08	—	—
p09	—	—

Table 22: TRIANGLE-TIREWORLD, experiment 1. Expanded nodes. Entries below are all timed out.

12 TRIANGLE-TIREWORLD, experiment 2a

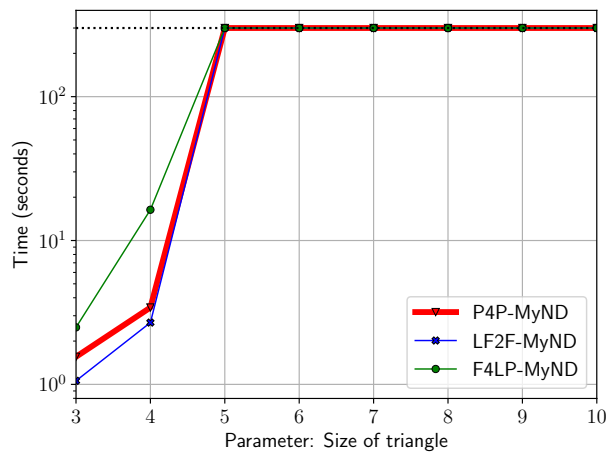


Figure 11: TRIANGLE-TIREWORLD, experiment 2a.

Benchmark name	P4P-MyND	F4LP-MyND	LF2F-MyND
p03	1.55	2.49	1.06
p04	3.42	16.36	2.69
p05	—	—	—

Table 23: TRIANGLE-TIREWORLD, experiment 2a. Running times.

Benchmark name	P4P-MyND	F4LP-MyND	LF2F-MyND
p03	54	365	93
p04	1168	4254	1167
p05	—	—	—

Table 24: TRIANGLE-TIREWORLD, experiment 2a. Number of expanded nodes.

13 TRIANGLE-TIREWORLD, experiment 2b

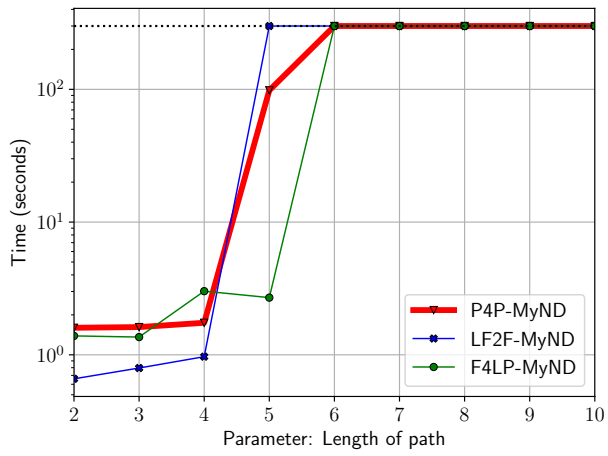


Figure 12: TRIANGLE-TIREWORLD, experiment 2b.

Benchmark name	P4P-MyND	F4LP-MyND	LF2F-MyND
p02	1.60	1.39	0.66
p03	1.62	1.36	0.80
p04	1.74	3.02	0.97
p05	98.27	2.70	—
p06	—	—	—

Table 25: TRIANGLE-TIREWORLD, experiment 2b. Running times.

Benchmark name	P4P-MyND	F4LP-MyND	LF2F-MyND
p02	1	5	4
p03	4	13	10
p04	10	514	22
p05	12239	61	—
p06	—	—	—

Table 26: TRIANGLE-TIREWORLD, experiment 2b. Number of expanded nodes.