Estimation of parameter importance and interaction with Random Forests

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In this document we are testing how to use Random Forest to assess importance and interactions of parameters based on the data gathered by irace.

For the analysis below we use as example SPEAR:

- 300 sec cut off time (par1)
- 26 parameters
- 302 SAT instances
- 178000 secs configuration budget

1. Importance by iterations

Iteration 1:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
26	sp.var.dec.heur	2.2778	145	8.4649946	443.3106267	78	30	0.0000000
7	sp.learned.clause.sort.heur	2.3377	126	7.1543459	358.8297060	77	29	0.0000000
2	instance	2.6700	347	-0.2940135	76.9409588	100	0	0.0000000
12	sp.orig.clause.sort.heur	3.8358	74	2.2734191	112.5757758	58	13	0.0341216
15	sp.rand.phase.scaling	4.2944	54	1.4512754	85.8276858	44	8	0.7788719
6	sp.first.restart	4.3447	60	0.3260965	36.9090014	47	2	0.4850107
13	sp.phase.dec.heur	4.4840	59	0.7574828	46.0915586	40	3	0.5377933
1	dummy	4.5745	68	0.6417980	22.8090709	45	1	0.1416761
16	sp.rand.var.dec.freq	4.6043	53	0.5373225	18.8211995	43	0	0.8173885
27	sp.variable.decay	4.6934	40	0.4139693	37.0879064	34	4	0.9972102
14	sp.rand.phase.dec.freq	4.7438	45	0.7568053	36.1789680	38	2	0.9790141
11	sp.max.res.runs	4.7738	46	0.9550659	35.1036453	38	0	0.9705842
22	sp.restart.inc	4.7739	45	1.2406195	29.2843276	39	0	0.9790141
18	sp.res.cutoff.cls	4.7936	42	0.5351924	25.5408018	36	1	0.9933029
17	sp.rand.var.dec.scaling	4.8536	44	0.4003917	15.2363546	36	2	0.9853406
20	sp.res.order.heur	4.9639	40	0.3290793	14.4240967	39	0	0.9972102
10	sp.max.res.lit.inc	5.0236	45	0.3014604	17.0928705	36	0	0.9790141
4	sp.clause.decay	5.0332	37	0.3976096	12.9072772	32	1	0.9993770
8	sp.learned.clauses.inc	5.0530	36	-0.0898090	9.4771881	30	1	0.9996414
25	sp.var.activity.inc	5.1028	29	0.1671769	8.9601629	28	0	0.9999967
19	sp.res.cutoff.lits	5.1029	38	0.3367660	10.3140843	29	1	0.9989463
9	sp.learned.size.factor	5.1424	26	0.3284956	18.6286185	24	2	0.9999997
5	sp.clause.del.heur	5.2128	30	0.2490887	4.5838939	28	0	0.9999929
21	sp.resolution	5.2923	27	0.2847738	10.1866467	23	0	0.9999994
3	sp.clause.activity.inc	5.5415	19	-0.0377711	1.9091528	15	0	1.0000000
23	sp.update.dec.queue	5.6715	15	0.0259916	0.4250335	15	0	1.0000000
24	sp.use.pure.literal.rule	5.7013	13	-0.0364072	0.5638842	13	0	1.0000000

Iteration 2:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.5988	204	48.1565039	4745.195051	96	36	0.0000000
13	sp.orig.clause.sort.heur	2.5608	214	30.6680489	2813.184228	86	17	0.0000000
8	sp.learned.clause.sort.heur	2.7492	209	18.1104645	1550.963490	89	9	0.0000000
2	instance	2.9600	756	-0.1863396	455.598432	100	0	0.0000000
21	sp.res.order.heur	3.2768	136	15.7945250	1426.561364	81	8	0.0075928
14	sp.phase.dec.heur	3.4928	124	21.4456096	1769.234634	76	14	0.0930466
15	sp.rand.phase.dec.freq	4.5276	112	7.8830545	593.739200	67	0	0.4281000
20	sp.res.cutoff.lits	4.7480	94	10.2521473	719.983497	60	7	0.9460358
9	sp.learned.clauses.inc	4.7848	106	2.6340799	211.074074	66	0	0.6569003
16	sp.rand.phase.scaling	4.8852	79	7.6509310	621.577298	59	2	0.9992729
1	dummy	5.0056	154	3.8030819	247.309846	77	0	0.0000280
7	sp.first.restart	5.2964	101	2.1868640	144.496889	63	0	0.8159118
11	sp.max.res.lit.inc	5.3844	59	7.7970594	642.073005	48	4	1.0000000
18	sp.rand.var.dec.scaling	5.5952	86	0.3825866	70.950300	59	0	0.9926018
17	sp.rand.var.dec.freq	5.6468	76	2.1479775	102.969956	56	0	0.9997759
12	sp.max.res.runs	5.6500	62	3.5281777	255.353622	50	2	0.9999998
23	sp.restart.inc	6.0184	74	1.8883398	139.859730	53	0	0.9999041
4	sp.clause.decay	6.0532	49	1.8100458	122.281531	44	1	1.0000000
28	sp.variable.decay	6.1232	54	0.8753891	90.679359	44	0	1.0000000
10	sp.learned.size.factor	6.2848	58	0.7335581	86.020161	41	0	1.0000000
22	sp.resolution	6.3652	45	1.0968037	123.148132	34	0	1.0000000
19	sp.res.cutoff.cls	6.3992	48	1.1588849	78.305013	39	0	1.0000000
5	sp.clause.del.heur	6.4836	43	0.3109060	49.373539	37	0	1.0000000
3	sp.clause.activity.inc	6.6368	38	0.5765171	45.552101	31	0	1.0000000
26	sp.var.activity.inc	6.7512	32	0.5011120	23.533286	29	0	1.0000000
25	sp.use.pure.literal.rule	6.9128	28	0.2541179	33.052233	26	0	1.0000000
24	sp.update.dec.queue	7.2704	19	-0.0525302	4.911102	18	0	1.0000000
6	sp.clause.inversion	7.4036	14	0.0475185	4.293600	12	0	1.0000000

Iteration 3:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
26	sp.var.dec.heur	1.4321	352	161.912394	21937.6631	99	37	0.0000022
7	sp.learned.clause.sort.heur	1.6021	471	122.647763	16069.3005	99	18	0.0000000
12	sp.orig.clause.sort.heur	2.6421	446	70.963097	9833.7249	99	13	0.0000000
2	instance	2.9300	1967	23.876339	12491.0577	100	0	0.0000000
15	sp.rand.phase.scaling	3.3184	257	35.579467	5478.1028	96	4	0.8582088
20	sp.res.order.heur	3.6505	223	29.869010	4658.4465	95	1	0.9994390
8	sp.learned.clauses.inc	4.1526	264	29.326156	3814.3948	94	4	0.7369857
6	sp.first.restart	4.5005	269	23.658865	3103.0292	95	1	0.6267803
25	sp.var.activity.inc	4.7399	151	34.446412	3408.3094	81	6	1.0000000
1	dummy	4.7842	381	7.650987	1412.6393	98	0	0.0000000
17	sp.rand.var.dec.scaling	4.8747	251	10.246519	1819.2766	93	0	0.9266068
18	sp.res.cutoff.cls	4.9552	174	20.264970	3337.3518	88	0	1.0000000
13	sp.phase.dec.heur	4.9815	173	31.413889	3060.5579	85	9	1.0000000
14	sp.rand.phase.dec.freq	4.9910	184	9.287763	1935.6343	90	0	1.0000000
22	sp.restart.inc	5.0526	239	11.208757	1677.7650	94	0	0.9866923
16	sp.rand.var.dec.freq	5.1915	166	19.935005	2298.9944	85	7	1.0000000
9	sp.learned.size.factor	5.4610	180	9.756397	1601.5884	90	0	1.0000000
5	sp.clause.del.heur	5.4778	174	11.114265	1283.2190	82	0	1.0000000
19	sp.res.cutoff.lits	5.7841	153	13.988109	2235.2625	79	0	1.0000000
11	sp.max.res.runs	6.0478	156	6.655084	957.4132	82	0	1.0000000
10	sp.max.res.lit.inc	6.1341	146	9.739369	1477.7735	79	0	1.0000000
4	sp.clause.decay	6.2041	136	4.340107	800.7480	79	0	1.0000000
27	sp.variable.decay	6.7099	146	3.676155	535.0842	81	0	1.0000000
23	sp.update.dec.queue	7.2572	97	2.460916	539.8861	68	0	1.0000000
3	sp.clause.activity.inc	7.4777	103	3.202962	615.2203	63	0	1.0000000
21	sp.resolution	7.9603	78	3.991969	497.3963	57	0	1.0000000
24	sp.use.pure.literal.rule	8.0513	58	4.744505	542.4612	47	0	1.0000000

Iteration 4:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.0900	339	1243.924263	523169.9965	100	36	0.9999988
8	sp.learned.clause.sort.heur	2.9900	578	304.464357	79877.6361	100	11	0.0000000
2	instance	3.1000	3202	-9.564533	13707.6175	100	0	0.0000000
13	sp.orig.clause.sort.heur	3.2400	607	205.537842	62529.4703	100	7	0.0000000
14	sp.phase.dec.heur	3.3806	279	305.469329	114333.5353	98	19	1.0000000
1	dummy	3.4300	1120	165.262445	46366.4479	100	0	0.0000000
16	sp.rand.phase.scaling	3.5000	584	112.910498	19758.9273	100	0	0.0000000
21	sp.res.order.heur	3.7809	293	145.667697	31651.3288	97	0	1.0000000
17	sp.rand.var.dec.freq	3.8200	450	103.737343	29639.7537	100	0	0.1864079
7	sp.first.restart	3.8803	404	124.605909	37926.2612	99	5	0.9150870
10	sp.learned.size.factor	3.9000	318	261.343486	51968.2946	100	0	1.0000000
9	sp.learned.clauses.inc	4.6930	210	155.803853	26606.8008	90	1	1.0000000
3	sp.clause.activity.inc	4.9400	237	224.552065	36435.1936	100	2	1.0000000
23	sp.restart.inc	5.3500	380	36.989997	8928.9092	100	0	0.9951537
18	sp.rand.var.dec.scaling	5.7400	378	79.713160	18507.0163	100	2	0.9964151
12	sp.max.res.runs	5.9224	215	45.387170	12221.7429	92	0	1.0000000
15	sp.rand.phase.dec.freq	5.9600	406	40.544915	13263.5474	100	0	0.8984316
26	sp.var.activity.inc	6.3721	205	74.529626	16945.8136	93	0	1.0000000
5	sp.clause.del.heur	6.6703	351	42.910933	13850.6547	99	0	0.9999781
4	sp.clause.decay	6.7006	309	64.058829	15919.5606	98	2	1.0000000
28	sp.variable.decay	6.7403	247	87.486812	49337.4213	99	15	1.0000000
20	sp.res.cutoff.lits	8.5854	178	14.707050	6180.5947	82	0	1.0000000
11	sp.max.res.lit.inc	8.7266	173	21.034674	5989.3659	78	0	1.0000000
22	sp.resolution	9.6475	136	5.402848	2004.3844	75	0	1.0000000
24	sp.update.dec.queue	10.4763	144	12.690823	2961.2420	79	0	1.0000000
19	sp.res.cutoff.cls	10.5090	122	7.112307	2605.1609	70	0	1.0000000
25	sp.use.pure.literal.rule	10.5345	175	17.215109	4168.8472	85	0	1.0000000
6	sp.clause.inversion	13.8404	38	1.145005	518.0495	32	0	1.0000000

Iteration 5:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.2000	1618	9028.6421353	7798191.527	100	31	0.0000000
8	sp.learned.clause.sort.heur	1.8500	1440	3634.5402981	2440348.593	100	22	0.0000000
21	sp.res.order.heur	2.0600	765	1775.8238870	1574213.897	100	11	0.0003279
13	sp.orig.clause.sort.heur	2.3300	1523	2193.2693812	1656132.158	100	2	0.0000000
18	sp.rand.var.dec.scaling	2.5200	506	2068.0049002	1267618.884	100	19	1.0000000
2	instance	3.1100	3486	296.6117212	1246548.843	100	0	0.0000000
17	sp.rand.var.dec.freq	3.1200	610	2020.3634931	1574281.292	100	7	0.9958210
7	sp.first.restart	3.6200	731	1274.5303710	847090.339	100	1	0.0170821
12	sp.max.res.runs	3.8471	421	648.3117944	539933.140	99	1	1.0000000
14	sp.phase.dec.heur	3.8700	687	606.2649029	589668.799	100	0	0.3370628
19	sp.res.cutoff.cls	4.4242	378	619.4259815	548520.222	98	3	1.0000000
1	dummy	4.4800	1382	643.2136058	546493.224	100	0	0.0000000
15	sp.rand.phase.dec.freq	4.5000	710	583.3555767	516758.021	100	0	0.0947391
16	sp.rand.phase.scaling	4.6200	745	853.9817341	593663.187	100	0	0.0040089
9	sp.learned.clauses.inc	5.0500	501	468.6363346	400722.902	100	0	1.0000000
11	sp.max.res.lit.inc	5.1113	348	426.8091091	286931.299	97	1	1.0000000
10	sp.learned.size.factor	5.1300	497	675.5995059	579611.807	100	1	1.0000000
20	sp.res.cutoff.lits	5.3971	352	256.2443403	223317.971	99	0	1.0000000
23	sp.restart.inc	5.8800	402	299.9324838	337470.591	100	0	1.0000000
4	sp.clause.decay	6.2984	334	220.5508563	235791.922	96	0	1.0000000
28	sp.variable.decay	6.6955	267	140.2599277	186074.634	95	0	1.0000000
3	sp.clause.activity.inc	6.8768	245	229.0784589	194206.065	92	1	1.0000000
5	sp.clause.del.heur	7.1668	258	106.0350529	158143.396	92	0	1.0000000
26	sp.var.activity.inc	7.4952	231	115.1825430	164741.460	88	0	1.0000000
25	sp.use.pure.literal.rule	8.3823	188	127.1754330	142154.246	87	0	1.0000000
22	sp.resolution	8.6559	149	56.8694327	58908.106	71	0	1.0000000
24	sp.update.dec.queue	9.3404	122	59.6253223	69190.317	76	0	1.0000000
6	sp.clause.inversion	11.9425	29	-0.3467926	770.029	25	0	1.0000000

Iteration 6:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.1200	1033	56856.77583	200641160.3	100	28	1.0e+00
21	sp.res.order.heur	1.4500	2267	19833.89269	28621258.8	100	29	0.0e+00
13	sp.orig.clause.sort.heur	2.1400	3130	16933.87502	32370315.5	100	9	0.0e+00
17	sp.rand.var.dec.freq	2.3400	1326	16004.33114	29050740.5	100	7	1.0e+00
11	sp.max.res.lit.inc	2.5300	888	8801.90875	16390462.9	100	12	1.0e+00
8	sp.learned.clause.sort.heur	2.5600	2952	14791.29160	27846831.7	100	3	0.0e+00
2	instance	3.1000	15044	125.08790	2943382.5	100	0	0.0e+00
14	sp.phase.dec.heur	3.4300	1499	7912.09106	14673809.5	100	4	1.0e+00
7	sp.first.restart	3.6400	1993	6068.17341	11842815.6	100	5	1.9e-06
16	sp.rand.phase.scaling	3.9000	1479	4454.33916	8608112.9	100	1	1.0e+00
19	sp.res.cutoff.cls	3.9300	1070	3493.08325	7044182.2	100	0	1.0e+00
15	sp.rand.phase.dec.freq	3.9400	1495	4253.84282	9002500.5	100	0	1.0e+00
18	sp.rand.var.dec.scaling	4.2200	1531	5004.60610	8406430.0	100	1	1.0e+00
20	sp.res.cutoff.lits	4.4900	1179	2742.95474	5454169.9	100	0	1.0e+00
10	sp.learned.size.factor	4.5800	1415	2808.88556	5914845.2	100	0	1.0e+00
1	dummy	4.5900	3288	3284.81661	7712689.8	100	0	0.0e+00
12	sp.max.res.runs	4.5900	1317	3586.79383	6399076.8	100	1	1.0e+00
23	sp.restart.inc	5.0000	1373	2790.64540	6183815.9	100	0	1.0e+00
9	sp.learned.clauses.inc	5.4100	1276	1527.10961	4289504.7	100	0	1.0e+00
5	sp.clause.del.heur	6.2800	814	901.92727	1996723.5	100	0	1.0e+00
4	sp.clause.decay	6.4600	904	1059.16998	2530754.5	100	0	1.0e+00
3	sp.clause.activity.inc	6.5700	737	634.29089	1773847.5	100	0	1.0e+00
26	sp.var.activity.inc	6.6600	578	443.35596	1401573.0	100	0	1.0e+00
28	sp.variable.decay	6.8900	613	517.37631	1600137.3	100	0	1.0e+00
25	sp.use.pure.literal.rule	7.9048	321	282.64588	1189475.6	97	0	1.0e+00
22	sp.resolution	8.0364	394	455.68897	861205.4	96	0	1.0e+00
24	sp.update.dec.queue	8.6780	239	153.25531	491907.3	95	0	1.0e+00
6	sp.clause.inversion	9.0552	158	76.67488	436562.2	78	0	1.0e+00

Iteration 7:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.1500	5818	61710.7264	127002084	100	30	0.0000000
8	sp.learned.clause.sort.heur	1.8400	6242	62087.4993	100343439	100	11	0.0000000
21	sp.res.order.heur	1.8400	3555	44463.2899	64500941	100	16	0.9979441
13	sp.orig.clause.sort.heur	1.8700	6631	61857.5321	99714803	100	11	0.0000000
20	sp.res.cutoff.lits	2.9500	1499	23090.7856	15781654	100	18	1.0000000
7	sp.first.restart	3.4800	4611	25624.0919	47760333	100	0	0.0000000
12	sp.max.res.runs	3.6000	1950	16352.1137	18515380	100	8	1.0000000
23	sp.restart.inc	3.7800	2865	16345.3507	25013110	100	0	1.0000000
14	sp.phase.dec.heur	3.8100	3272	15171.4199	27901362	100	1	1.0000000
16	sp.rand.phase.scaling	3.9800	3291	15430.2346	29437137	100	0	1.0000000
15	sp.rand.phase.dec.freq	4.0200	3253	13208.0246	28517258	100	0	1.0000000
2	instance	4.0400	30105	-690.8936	11395282	100	0	1.0000000
18	sp.rand.var.dec.scaling	4.2000	3422	13356.9075	27138174	100	0	0.9999999
17	sp.rand.var.dec.freq	4.2600	3034	11755.9178	26680279	100	0	1.0000000
1	dummy	4.4800	6243	10420.3750	23891277	100	0	0.0000000
9	sp.learned.clauses.inc	4.5200	2840	11034.5756	21203493	100	0	1.0000000
10	sp.learned.size.factor	4.5700	2610	10916.9332	20646143	100	0	1.0000000
19	sp.res.cutoff.cls	4.7400	1539	8369.6038	12337286	100	3	1.0000000
11	sp.max.res.lit.inc	5.0800	1636	6049.2853	11460214	100	0	1.0000000
4	sp.clause.decay	5.5400	1586	7703.5051	9684238	100	1	1.0000000
26	sp.var.activity.inc	5.8800	1454	3097.6155	8036512	100	0	1.0000000
28	sp.variable.decay	5.9000	1550	3806.8920	8819685	100	0	1.0000000
5	sp.clause.del.heur	5.9400	1615	3497.0053	7819414	100	0	1.0000000
3	sp.clause.activity.inc	6.0100	1454	3497.1308	8048826	100	0	1.0000000
22	sp.resolution	6.2173	574	5124.7071	4152684	97	1	1.0000000
25	sp.use.pure.literal.rule	7.0900	631	1019.4436	3118211	100	0	1.0000000
24	sp.update.dec.queue	7.5900	602	925.5982	3282600	100	0	1.0000000
6	sp.clause.inversion	7.8691	428	807.1585	2642342	99	0	1.0000000

Iteration 8:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.3200	1084	29575.0620	77826259.9	100	26	1.0000000
17	sp.rand.var.dec.freq	1.9200	1023	13577.3222	20344979.4	100	27	1.0000000
13	sp.orig.clause.sort.heur	2.2600	2943	15244.3652	38929034.8	100	0	0.0000000
2	instance	2.3400	8942	1824.1350	14700310.1	100	0	0.0000000
8	sp.learned.clause.sort.heur	2.3400	2895	14937.0462	34688165.8	100	2	0.0000000
21	sp.res.order.heur	3.1208	327	1886.4804	3122681.9	97	13	1.0000000
14	sp.phase.dec.heur	3.5500	1556	7095.1023	15261727.4	100	0	0.0000000
16	sp.rand.phase.scaling	3.9100	1358	4557.4059	10069053.1	100	0	0.0319839
18	sp.rand.var.dec.scaling	4.0500	1370	4884.2854	10717109.4	100	1	0.0143878
7	sp.first.restart	4.1100	1941	4788.3617	13262099.8	100	0	0.0000000
15	sp.rand.phase.dec.freq	4.1800	1335	3110.0531	8416492.0	100	0	0.1132753
1	dummy	4.3100	3333	3093.0148	9682195.0	100	0	0.0000000
23	sp.restart.inc	4.7800	1152	3405.8862	8598007.4	100	0	0.9999735
9	sp.learned.clauses.inc	4.8000	1451	3587.8800	9498413.7	100	0	0.0000050
10	sp.learned.size.factor	5.0100	1290	3103.9107	7225620.3	100	0	0.5236763
11	sp.max.res.lit.inc	6.0772	137	1361.6000	2426852.5	73	6	1.0000000
28	sp.variable.decay	6.2500	678	1271.4300	3320934.6	100	0	1.0000000
12	sp.max.res.runs	6.2916	152	1334.3546	2271372.1	69	7	1.0000000
3	sp.clause.activity.inc	6.3400	525	917.9116	3169267.8	100	0	1.0000000
4	sp.clause.decay	6.5436	528	976.6970	3242277.1	99	0	1.0000000
20	sp.res.cutoff.lits	6.6052	114	998.1657	1842223.1	68	4	1.0000000
5	sp.clause.del.heur	6.8936	578	941.8459	3395169.7	99	0	1.0000000
26	sp.var.activity.inc	7.0136	479	492.1408	1926420.2	99	0	1.0000000
19	sp.res.cutoff.cls	7.0568	104	892.3635	1557526.7	62	4	1.0000000
24	sp.update.dec.queue	7.2052	285	785.9274	2448943.1	93	0	1.0000000
6	sp.clause.inversion	7.4416	247	392.7495	979575.4	94	0	1.0000000
25	sp.use.pure.literal.rule	7.5108	278	1122.2431	2981246.5	97	0	1.0000000
22	sp.resolution	7.8380	64	1635.9223	2590701.2	45	10	1.0000000

Iteration 9:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.07	8511	83412.9585	361374926	100	33	0.0000000
18	sp.rand.var.dec.scaling	1.80	3816	30893.5810	75182936	100	23	1.0000000
17	sp.rand.var.dec.freq	2.17	3426	19663.7241	55595509	100	17	1.0000000
8	sp.learned.clause.sort.heur	2.27	10302	25394.8523	76225785	100	5	0.0000000
13	sp.orig.clause.sort.heur	2.60	10667	22354.4766	73158508	100	6	0.0000000
14	sp.phase.dec.heur	2.73	4496	18692.5063	43688454	100	7	0.9999975
21	sp.res.order.heur	2.78	1937	4526.9154	20911615	100	6	1.0000000
2	instance	3.34	34316	7884.3046	67213724	100	0	0.0000000
15	sp.rand.phase.dec.freq	3.71	4499	5329.2180	19471725	100	0	0.9999970
7	sp.first.restart	3.82	6546	9251.7059	29625753	100	0	0.0000000
16	sp.rand.phase.scaling	3.88	4904	5428.4797	17782843	100	1	0.0709392
9	sp.learned.clauses.inc	4.45	4648	4831.0593	15736389	100	0	0.9892727
12	sp.max.res.runs	4.52	1304	1435.2579	6782283	100	0	1.0000000
1	dummy	4.58	8334	5863.5942	23551869	100	0	0.0000000
23	sp.restart.inc	4.61	4377	4035.9688	15242167	100	2	1.0000000
20	sp.res.cutoff.lits	4.68	1232	1446.8318	6137601	100	0	1.0000000
10	sp.learned.size.factor	4.73	4585	5495.1148	18271837	100	0	0.9993970
11	sp.max.res.lit.inc	4.80	1261	1217.1364	6252981	100	0	1.0000000
19	sp.res.cutoff.cls	4.88	1255	768.9289	4120638	100	0	1.0000000
28	sp.variable.decay	5.46	2694	1916.1003	7807732	100	0	1.0000000
26	sp.var.activity.inc	5.77	1941	1240.6542	5829689	100	0	1.0000000
4	sp.clause.decay	5.87	1843	1127.9962	5387324	100	0	1.0000000
5	sp.clause.del.heur	5.91	1890	1377.4040	6667024	100	0	1.0000000
3	sp.clause.activity.inc	6.02	2055	1274.4999	6445840	100	0	1.0000000
22	sp.resolution	6.23	815	540.6709	2587340	100	0	1.0000000
25	sp.use.pure.literal.rule	6.66	1075	1008.4722	3872603	100	0	1.0000000
6	sp.clause.inversion	7.18	897	518.1889	2050909	100	0	1.0000000
24	sp.update.dec.queue	7.88	868	363.1208	1969553	100	0	1.0000000

Iteration 10:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.07	8511	83412.9585	361374926	100	33	0.0000000
18	sp.rand.var.dec.scaling	1.80	3816	30893.5810	75182936	100	23	1.0000000
17	sp.rand.var.dec.freq	2.17	3426	19663.7241	55595509	100	17	1.0000000
8	sp.learned.clause.sort.heur	2.27	10302	25394.8523	76225785	100	5	0.0000000
13	sp.orig.clause.sort.heur	2.60	10667	22354.4766	73158508	100	6	0.0000000
14	sp.phase.dec.heur	2.73	4496	18692.5063	43688454	100	7	0.9999975
21	sp.res.order.heur	2.78	1937	4526.9154	20911615	100	6	1.0000000
2	instance	3.34	34316	7884.3046	67213724	100	0	0.0000000
15	sp.rand.phase.dec.freq	3.71	4499	5329.2180	19471725	100	0	0.9999970
7	sp.first.restart	3.82	6546	9251.7059	29625753	100	0	0.0000000
16	sp.rand.phase.scaling	3.88	4904	5428.4797	17782843	100	1	0.0709392
9	sp.learned.clauses.inc	4.45	4648	4831.0593	15736389	100	0	0.9892727
12	sp.max.res.runs	4.52	1304	1435.2579	6782283	100	0	1.0000000
1	dummy	4.58	8334	5863.5942	23551869	100	0	0.0000000
23	sp.restart.inc	4.61	4377	4035.9688	15242167	100	2	1.0000000
20	sp.res.cutoff.lits	4.68	1232	1446.8318	6137601	100	0	1.0000000
10	sp.learned.size.factor	4.73	4585	5495.1148	18271837	100	0	0.9993970
11	sp.max.res.lit.inc	4.80	1261	1217.1364	6252981	100	0	1.0000000
19	sp.res.cutoff.cls	4.88	1255	768.9289	4120638	100	0	1.0000000
28	sp.variable.decay	5.46	2694	1916.1003	7807732	100	0	1.0000000
26	sp.var.activity.inc	5.77	1941	1240.6542	5829689	100	0	1.0000000
4	sp.clause.decay	5.87	1843	1127.9962	5387324	100	0	1.0000000
5	sp.clause.del.heur	5.91	1890	1377.4040	6667024	100	0	1.0000000
3	sp.clause.activity.inc	6.02	2055	1274.4999	6445840	100	0	1.0000000
22	sp.resolution	6.23	815	540.6709	2587340	100	0	1.0000000
25	sp.use.pure.literal.rule	6.66	1075	1008.4722	3872603	100	0	1.0000000
6	sp.clause.inversion	7.18	897	518.1889	2050909	100	0	1.0000000
24	sp.update.dec.queue	7.88	868	363.1208	1969553	100	0	1.0000000

Iteration 11:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.1800	1057	53528.87438	263207500.9	100	27	1.0000000
11	sp.max.res.lit.inc	1.8300	724	11763.04302	25040961.6	100	20	1.0000000
8	sp.learned.clause.sort.heur	2.4000	3313	18935.78875	59100251.3	100	1	0.0000000
19	sp.res.cutoff.cls	2.5200	656	7912.24006	14265091.4	100	23	1.0000000
13	sp.orig.clause.sort.heur	2.5400	3241	16753.14073	53457630.0	100	1	0.0000000
17	sp.rand.var.dec.freq	2.5900	1283	11098.89919	32073989.8	100	4	1.0000000
21	sp.res.order.heur	2.6500	1596	10683.10126	25301900.0	100	6	0.9697240
14	sp.phase.dec.heur	3.0200	1256	12841.76498	24601444.5	100	7	1.0000000
2	instance	3.2500	14210	63.49065	2830088.6	100	0	0.0000000
18	sp.rand.var.dec.scaling	3.8600	1674	4234.01565	14286469.0	100	0	0.4679750
1	dummy	4.1800	3535	3494.36445	11589926.6	100	0	1.0000000
7	sp.first.restart	4.2400	1841	5800.25269	16107350.5	100	1	0.0000149
12	sp.max.res.runs	4.3200	853	3775.31067	9237796.4	100	2	1.0000000
15	sp.rand.phase.dec.freq	4.3300	1506	5429.62110	14834820.2	100	0	0.9999850
16	sp.rand.phase.scaling	4.5500	1287	2887.00235	8530974.2	100	0	1.0000000
9	sp.learned.clauses.inc	4.7000	1247	2547.42497	9475512.7	100	0	1.0000000
20	sp.res.cutoff.lits	4.8600	668	2958.06764	5815199.3	100	4	1.0000000
10	sp.learned.size.factor	4.9200	1211	3937.86229	8948512.8	100	3	1.0000000
23	sp.restart.inc	5.0800	1279	2918.13862	10597849.1	100	0	1.0000000
26	sp.var.activity.inc	6.2400	794	971.46054	3220031.6	100	0	1.0000000
4	sp.clause.decay	6.3351	712	921.34815	4014514.3	99	0	1.0000000
28	sp.variable.decay	6.4900	687	683.61332	2818724.7	100	0	1.0000000
5	sp.clause.del.heur	7.1600	473	701.21516	3316581.3	100	0	1.0000000
22	sp.resolution	7.3904	409	689.44980	2088548.0	96	1	1.0000000
3	sp.clause.activity.inc	7.5300	484	475.69899	2649395.6	100	0	1.0000000
25	sp.use.pure.literal.rule	7.5451	421	622.84444	2056257.1	99	0	1.0000000
24	sp.update.dec.queue	7.7953	274	1202.36449	3390741.4	97	0	1.0000000
6	sp.clause.inversion	10.1595	81	86.27681	574793.8	55	0	1.0000000

Iteration 12:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.0600	6989	83190.5666	380408672	100	29	0.0000000
21	sp.res.order.heur	1.8100	4627	27938.3855	63194360	100	20	1.0000000
13	sp.orig.clause.sort.heur	2.0800	9000	44908.9735	133219668	100	13	0.0000000
8	sp.learned.clause.sort.heur	2.2800	8754	46136.3084	135830015	100	0	0.0000000
14	sp.phase.dec.heur	2.7700	4337	24903.2745	63235932	100	2	1.0000000
11	sp.max.res.lit.inc	2.8600	1949	17820.0608	23198800	100	20	1.0000000
18	sp.rand.var.dec.scaling	3.1300	3700	16735.0812	40631324	100	2	1.0000000
7	sp.first.restart	3.4300	5126	18452.4511	54299495	100	0	0.1711174
15	sp.rand.phase.dec.freq	3.7200	4816	14664.0346	41717680	100	0	0.9997794
17	sp.rand.var.dec.freq	3.9900	3401	9586.7115	33948851	100	0	1.0000000
19	sp.res.cutoff.cls	4.0100	2202	9829.7950	15200075	100	9	1.0000000
16	sp.rand.phase.scaling	4.3000	3885	9840.7032	31031552	100	0	1.0000000
2	instance	4.3200	45734	2611.4356	64748770	100	0	0.0000000
12	sp.max.res.runs	4.3400	2497	7169.0346	15501088	100	3	1.0000000
23	sp.restart.inc	4.6100	3611	7319.1857	27769889	100	0	1.0000000
10	sp.learned.size.factor	4.6900	3960	8637.3334	27156107	100	0	1.0000000
1	dummy	4.8000	7914	8615.2819	33370490	100	0	0.0000000
9	sp.learned.clauses.inc	4.8100	3527	7609.5352	26176313	100	0	1.0000000
20	sp.res.cutoff.lits	5.1000	2230	4416.6995	12448991	100	0	1.0000000
26	sp.var.activity.inc	5.6600	2366	3279.5022	11098980	100	0	1.0000000
4	sp.clause.decay	5.7100	1943	2934.5082	12630566	100	0	1.0000000
5	sp.clause.del.heur	5.9300	1666	2883.6218	13018975	100	0	1.0000000
28	sp.variable.decay	5.9500	2163	2548.1239	9869656	100	0	1.0000000
3	sp.clause.activity.inc	6.1600	1607	1770.9344	9304951	100	0	1.0000000
25	sp.use.pure.literal.rule	6.4600	1313	1328.1220	4539743	100	0	1.0000000
22	sp.resolution	6.8100	1060	2221.5385	3420365	100	2	1.0000000
24	sp.update.dec.queue	6.9100	858	1760.8147	7823945	100	0	1.0000000
6	sp.clause.inversion	7.9182	422	517.7111	4391001	99	0	1.0000000

Iteration 13:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.35	1017	1686.356119	1792110.775	100	23	0.0000000
19	sp.res.cutoff.cls	1.36	447	1977.771643	1820767.695	100	30	1.0000000
21	sp.res.order.heur	1.95	1370	1223.912648	1302865.572	100	7	0.0000000
11	sp.max.res.lit.inc	2.10	602	1337.567440	1273409.801	100	18	0.9999978
8	sp.learned.clause.sort.heur	2.33	1212	755.040241	676661.282	100	7	0.0000000
13	sp.orig.clause.sort.heur	2.37	1294	894.859311	892956.365	100	2	0.0000000
7	sp.first.restart	2.98	702	432.445668	312511.581	100	6	0.7492518
2	instance	3.80	6135	-29.166904	102383.822	100	0	0.0000000
20	sp.res.cutoff.lits	3.86	439	196.540815	272399.402	99	0	1.0000000
18	sp.rand.var.dec.scaling	4.30	486	145.707131	138121.129	100	0	1.0000000
16	sp.rand.phase.scaling	4.31	506	196.424566	149780.777	100	0	1.0000000
1	dummy	4.47	1055	229.993656	161515.555	100	0	0.0000000
17	sp.rand.var.dec.freq	4.49	500	102.988966	109941.311	100	0	1.0000000
23	sp.restart.inc	4.61	515	122.186265	129000.043	100	0	1.0000000
10	sp.learned.size.factor	4.75	497	87.960792	88489.093	99	0	1.0000000
12	sp.max.res.runs	4.76	457	97.320843	98163.667	99	0	1.0000000
15	sp.rand.phase.dec.freq	4.78	545	121.700277	137425.464	100	0	1.0000000
14	sp.phase.dec.heur	5.21	446	69.901657	80371.861	100	0	1.0000000
9	sp.learned.clauses.inc	5.68	328	45.694854	61256.907	97	0	1.0000000
26	sp.var.activity.inc	6.20	248	177.890173	91026.395	97	6	1.0000000
3	sp.clause.activity.inc	6.56	208	34.393115	45493.147	92	0	1.0000000
4	sp.clause.decay	6.58	236	40.377465	37621.507	92	0	1.0000000
28	sp.variable.decay	6.83	223	10.412909	17516.222	89	0	1.0000000
24	sp.update.dec.queue	6.87	152	29.607918	40271.441	84	0	1.0000000
22	sp.resolution	7.12	173	75.123446	56146.131	82	0	1.0000000
5	sp.clause.del.heur	7.16	163	28.499178	29530.560	85	0	1.0000000
25	sp.use.pure.literal.rule	7.94	145	38.066556	28363.996	78	1	1.0000000
6	sp.clause.inversion	9.70	39	4.024221	8040.927	28	0	1.0000000

Iteration 14:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.120	894	2098.334665	2153982.034	100	29	0.0000000
21	sp.res.order.heur	1.410	937	1520.031719	1215885.661	100	22	0.0000000
13	sp.orig.clause.sort.heur	2.070	922	1051.798804	806449.391	100	12	0.0000000
8	sp.learned.clause.sort.heur	2.290	897	811.839938	720712.301	100	1	0.0000000
2	instance	3.440	4454	-5.464962	21309.095	100	0	0.0000000
14	sp.phase.dec.heur	3.850	334	409.103025	260935.223	96	11	1.0000000
11	sp.max.res.lit.inc	3.985	236	512.116063	257915.500	91	15	1.0000000
17	sp.rand.var.dec.freq	4.025	419	248.128336	216743.406	99	1	0.9999986
7	sp.first.restart	4.180	447	167.117119	159460.312	100	0	0.9996135
12	sp.max.res.runs	4.205	402	168.507857	167391.389	99	0	1.0000000
18	sp.rand.var.dec.scaling	4.475	357	381.822031	201231.055	97	5	1.0000000
1	dummy	4.520	954	99.751437	116973.267	100	0	0.0000000
15	sp.rand.phase.dec.freq	4.620	371	148.735653	133842.765	100	4	1.0000000
9	sp.learned.clauses.inc	4.865	286	97.604527	95580.347	99	0	1.0000000
19	sp.res.cutoff.cls	4.945	346	163.240906	103630.822	97	0	1.0000000
20	sp.res.cutoff.lits	4.960	336	150.305793	158649.245	96	0	1.0000000
10	sp.learned.size.factor	5.205	351	91.287417	77961.944	99	0	1.0000000
16	sp.rand.phase.scaling	5.385	300	115.642751	107864.706	97	0	1.0000000
23	sp.restart.inc	5.500	330	76.998761	78516.919	98	0	1.0000000
26	sp.var.activity.inc	6.210	216	86.839137	79211.696	90	0	1.0000000
4	sp.clause.decay	7.235	149	50.423808	46567.063	85	0	1.0000000
22	sp.resolution	7.415	105	148.910757	72081.743	65	0	1.0000000
28	sp.variable.decay	7.715	139	12.505587	15926.430	77	0	1.0000000
5	sp.clause.del.heur	7.820	125	24.175607	28199.782	70	0	1.0000000
3	sp.clause.activity.inc	8.565	105	10.161393	15364.091	69	0	1.0000000
25	sp.use.pure.literal.rule	9.040	76	15.911980	12668.881	52	0	1.0000000
24	sp.update.dec.queue	9.785	53	6.825797	6855.235	39	0	1.0000000
6	sp.clause.inversion	10.610	24	3.117857	3847.011	22	0	1.0000000

Iteration 15:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.1100	786	1787.7090731	1764221.1690	100	40	0.0000000
21	sp.res.order.heur	1.9300	1081	781.5706479	598539.0744	100	11	0.0000000
8	sp.learned.clause.sort.heur	2.2700	944	569.8071131	452559.9352	100	6	0.0000000
13	sp.orig.clause.sort.heur	2.3500	904	455.4974514	344960.4967	100	10	0.0000000
19	sp.res.cutoff.cls	2.4300	428	710.9314021	554452.2685	100	15	1.0000000
11	sp.max.res.lit.inc	2.7000	403	397.9255119	267596.8683	100	8	1.0000000
7	sp.first.restart	3.3400	698	234.0696218	195942.5908	100	3	0.0000015
2	instance	3.5400	4887	-22.5117028	75977.1174	100	0	0.0000000
1	dummy	3.8200	958	199.4721014	207959.3306	100	0	0.0000000
20	sp.res.cutoff.lits	4.2057	348	152.9155197	137271.3602	97	0	1.0000000
14	sp.phase.dec.heur	4.3238	423	146.1594276	131010.2527	98	1	1.0000000
16	sp.rand.phase.scaling	4.4319	413	101.7472063	100501.2188	99	0	1.0000000
10	sp.learned.size.factor	4.4400	380	168.2700737	104265.0382	100	4	1.0000000
15	sp.rand.phase.dec.freq	4.4600	516	103.8169745	110876.7262	100	0	0.9982300
12	sp.max.res.runs	4.6019	406	111.7458610	98434.4634	99	2	1.0000000
9	sp.learned.clauses.inc	4.7857	378	120.1564802	107024.2481	97	0	1.0000000
17	sp.rand.var.dec.freq	4.9095	333	88.2746032	84316.6126	95	0	1.0000000
23	sp.restart.inc	4.9519	382	61.8878372	60127.3572	99	0	1.0000000
18	sp.rand.var.dec.scaling	5.0357	378	65.9397864	64818.0533	97	0	1.0000000
26	sp.var.activity.inc	6.3204	189	61.5189343	48211.8947	84	0	1.0000000
28	sp.variable.decay	6.3685	198	29.8382692	33803.1513	85	0	1.0000000
4	sp.clause.decay	6.4157	225	22.3130939	23488.7793	97	0	1.0000000
5	sp.clause.del.heur	6.9737	147	27.2243971	30078.1604	77	0	1.0000000
22	sp.resolution	7.2842	158	22.0568729	18825.6579	82	0	1.0000000
3	sp.clause.activity.inc	7.2980	136	24.7874499	28546.9747	80	0	1.0000000
25	sp.use.pure.literal.rule	8.0775	133	23.1912772	21473.3122	75	0	1.0000000
24	sp.update.dec.queue	8.5546	86	5.8936448	7489.7419	66	0	1.0000000
6	sp.clause.inversion	10.4858	20	0.5035788	736.9731	18	0	1.0000000

Iteration 16:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
11	sp.max.res.lit.inc	1.690	372	825.212609	733247.298	100	30	1.0000000
21	sp.res.order.heur	1.770	952	942.709990	826776.355	100	19	0.0000000
13	sp.orig.clause.sort.heur	1.880	883	816.454175	738239.885	100	13	0.0000000
19	sp.res.cutoff.cls	1.890	438	1091.196115	720316.340	100	23	1.0000000
27	sp.var.dec.heur	2.150	918	847.655755	709191.649	100	1	0.0000000
8	sp.learned.clause.sort.heur	2.510	1050	696.061534	600085.727	100	3	0.0000000
7	sp.first.restart	2.980	571	349.350988	252399.507	100	5	0.7132714
2	instance	3.500	5199	-27.569353	85055.068	100	0	0.0000000
14	sp.phase.dec.heur	3.879	410	237.869074	175597.378	99	2	1.0000000
1	dummy	4.210	913	141.370634	119653.623	100	0	1.0000000
15	sp.rand.phase.dec.freq	4.440	433	152.129419	121175.532	100	0	1.0000000
12	sp.max.res.runs	4.618	367	70.112080	86854.594	98	0	1.0000000
16	sp.rand.phase.scaling	4.817	315	110.095414	96744.176	97	0	1.0000000
17	sp.rand.var.dec.freq	4.988	424	120.831765	101750.175	98	0	1.0000000
20	sp.res.cutoff.lits	5.000	367	80.498639	81269.263	100	0	1.0000000
18	sp.rand.var.dec.scaling	5.029	417	101.843446	82282.849	99	0	1.0000000
23	sp.restart.inc	5.030	412	96.323524	96217.720	100	0	1.0000000
10	sp.learned.size.factor	5.050	417	129.414266	99239.855	100	0	1.0000000
9	sp.learned.clauses.inc	6.266	217	48.749011	46614.148	86	0	1.0000000
26	sp.var.activity.inc	6.367	215	52.855321	38511.729	87	0	1.0000000
4	sp.clause.decay	6.419	218	32.258210	36944.079	89	0	1.0000000
28	sp.variable.decay	6.674	195	40.078656	40191.439	84	0	1.0000000
5	sp.clause.del.heur	7.230	151	36.465005	30458.063	80	0	1.0000000
22	sp.resolution	7.577	127	31.148490	25158.674	67	1	1.0000000
25	sp.use.pure.literal.rule	7.619	116	53.189326	36213.469	69	3	1.0000000
3	sp.clause.activity.inc	7.841	157	7.708752	13741.594	81	0	1.0000000
24	sp.update.dec.queue	9.022	55	16.605037	23053.325	42	0	1.0000000
6	sp.clause.inversion	9.364	42	2.707933	6254.777	34	0	1.0000000

Iteration 17:

	variable	mean_min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.0600	337	1280.6898910	1.504549e+06	100	33	0.2969773
21	sp.res.order.heur	1.5600	572	492.0711113	3.914474e+05	100	28	0.0000000
13	sp.orig.clause.sort.heur	2.1200	537	425.5946687	3.045852e+05	100	7	0.0000000
8	sp.learned.clause.sort.heur	2.3796	497	268.0980415	2.115766e+05	99	17	0.0000000
2	instance	2.4300	2938	-1.5178057	1.166086e+04	100	0	0.0000000
1	dummy	4.0196	616	138.2517196	9.152480e+04	99	1	0.0000000
7	sp.first.restart	4.6600	380	60.1982985	4.865840e+04	100	2	0.0019553
20	sp.res.cutoff.lits	4.7080	245	156.8730111	1.503433e+05	95	0	0.9999994
14	sp.phase.dec.heur	4.7360	191	144.2727726	1.189841e+05	90	2	1.0000000
19	sp.res.cutoff.cls	4.9568	260	161.3873872	9.976931e+04	92	6	0.9999590
18	sp.rand.var.dec.scaling	5.2076	240	106.2001826	8.674326e+04	94	1	0.9999999
12	sp.max.res.runs	5.2984	296	72.5294085	6.067675e+04	96	0	0.9641915
15	sp.rand.phase.dec.freq	5.4084	302	46.1160398	3.720671e+04	96	0	0.9269858
17	sp.rand.var.dec.freq	5.8256	206	42.8760590	4.590677e+04	89	0	1.0000000
11	sp.max.res.lit.inc	5.8760	207	48.1702972	3.027701e+04	90	3	1.0000000
10	sp.learned.size.factor	5.9448	185	65.4437337	5.738588e+04	87	0	1.0000000
16	sp.rand.phase.scaling	5.9556	219	49.7918543	3.597015e+04	89	0	1.0000000
23	sp.restart.inc	6.5064	231	43.7317150	3.101404e+04	91	0	1.0000000
9	sp.learned.clauses.inc	6.5764	172	33.4360922	3.109855e+04	91	0	1.0000000
26	sp.var.activity.inc	8.5360	101	12.7505477	1.294017e+04	65	0	1.0000000
4	sp.clause.decay	8.6664	105	14.6876081	1.732093e+04	66	0	1.0000000
28	sp.variable.decay	9.0928	91	9.2822820	7.040424e+03	57	0	1.0000000
22	sp.resolution	9.4392	68	13.1229004	8.927320e+03	48	0	1.0000000
25	sp.use.pure.literal.rule	9.6580	53	5.6337485	5.959911e+03	45	0	1.0000000
5	sp.clause.del.heur	9.8160	48	5.5511125	5.904544e+03	40	0	1.0000000
3	sp.clause.activity.inc	9.9580	57	4.0278617	5.220041e+03	45	0	1.0000000
6	sp.clause.inversion	11.7216	4	-0.0000373	1.948690e-02	4	0	1.0000000
24	sp.update.dec.queue	11.7808	2	0.1214918	7.960261e+02	2	0	1.0000000

Iteration 18:

	variable	mean__min__depth	no__of__nodes	mse__increase	node__purity__increase	no__of__trees	times__a__root	p__value
21	sp.res.order.heur	1.430	540	231.7214858	157387.1776	100	32	0.0000000
8	sp.learned.clause.sort.heur	1.830	523	209.5957503	116474.2561	100	15	0.0000000
13	sp.orig.clause.sort.heur	1.950	470	186.1294068	113937.3616	100	23	0.0000000
27	sp.var.dec.heur	2.440	483	174.4122058	133304.0649	100	6	0.0000000
2	instance	2.700	2133	-5.2781224	54194.1217	100	0	0.0000000
1	dummy	3.790	660	72.4350335	50863.4246	100	0	0.0000000
18	sp.rand.var.dec.scaling	4.266	232	50.1524337	30515.5234	94	6	0.9909914
7	sp.first.restart	4.538	254	43.1083550	28371.7528	92	1	0.8297100
12	sp.max.res.runs	4.646	213	34.4680328	23807.4989	89	1	0.9998525
14	sp.phase.dec.heur	4.672	204	37.5024949	44197.0926	93	0	0.9999881
20	sp.res.cutoff.lits	4.788	176	37.2404919	23315.5995	87	3	1.0000000
10	sp.learned.size.factor	5.142	177	17.7223429	16598.4364	88	0	1.0000000
15	sp.rand.phase.dec.freq	5.260	137	28.7379375	15471.1180	80	7	1.0000000
17	sp.rand.var.dec.freq	5.602	130	15.9270165	14909.6918	78	2	1.0000000
9	sp.learned.clauses.inc	5.686	182	27.0345638	23258.2411	84	0	1.0000000
23	sp.restart.inc	5.884	143	19.2394993	17381.1099	76	1	1.0000000
19	sp.res.cutoff.cls	5.930	175	18.2147494	12684.1761	80	1	1.0000000
16	sp.rand.phase.scaling	6.188	125	16.0437777	18258.0031	72	1	1.0000000
11	sp.max.res.lit.inc	6.624	113	7.5686412	6976.9949	66	1	1.0000000
26	sp.var.activity.inc	6.892	111	10.1815932	8818.3192	63	0	1.0000000
28	sp.variable.decay	7.708	59	3.3882127	4116.3231	47	0	1.0000000
5	sp.clause.del.heur	7.844	63	2.9086248	6143.3644	46	0	1.0000000
4	sp.clause.decay	7.868	55	1.4145601	1934.9645	42	0	1.0000000
3	sp.clause.activity.inc	7.874	54	3.4387954	3802.8720	41	0	1.0000000
22	sp.resolution	8.162	47	3.0541430	4872.9749	38	0	1.0000000
6	sp.clause.inversion	8.486	26	0.0201802	132.2758	24	0	1.0000000
25	sp.use.pure.literal.rule	8.646	28	1.4571464	1829.0737	24	0	1.0000000
24	sp.update.dec.queue	9.030	15	1.3791194	1919.8313	15	0	1.0000000

Iteration 19:

	variable	mean__min__depth	no__of__nodes	mse__increase	node__purity__increase	no__of__trees	times__a__root	p__value
27	sp.var.dec.heur	1.2900	617	783.2085932	663382.462	100	33	0.0000000
13	sp.orig.clause.sort.heur	1.7200	637	524.3134477	448648.639	100	18	0.0000000
21	sp.res.order.heur	1.9300	557	532.4000764	336758.383	100	19	0.0000000
8	sp.learned.clause.sort.heur	2.4800	674	429.3700977	293306.208	100	16	0.0000000
14	sp.phase.dec.heur	2.7700	458	363.5810260	273809.424	100	4	0.0016273
2	instance	2.9500	3413	-9.7999634	36103.591	100	0	0.0000000
7	sp.first.restart	3.8646	388	132.5834707	112472.054	98	2	0.7132742
1	dummy	4.0700	852	80.2889477	78311.107	100	0	0.0000000
20	sp.res.cutoff.lits	4.2215	264	100.3742201	82197.240	95	0	1.0000000
16	sp.rand.phase.scaling	4.8038	273	113.3851581	105130.794	94	0	1.0000000
15	sp.rand.phase.dec.freq	4.9730	225	70.4829918	79531.608	90	4	1.0000000
23	sp.restart.inc	5.1669	287	114.7669603	80528.004	97	0	1.0000000
10	sp.learned.size.factor	5.5638	296	37.6379533	37375.049	94	2	1.0000000
11	sp.max.res.lit.inc	5.8730	225	82.0456598	53792.313	90	0	1.0000000
17	sp.rand.var.dec.freq	5.9330	197	80.5940627	48703.045	90	0	1.0000000
19	sp.res.cutoff.cls	5.9338	269	57.6927894	44079.267	94	0	1.0000000
9	sp.learned.clauses.inc	6.0638	233	52.6126197	36987.593	94	0	1.0000000
18	sp.rand.var.dec.scaling	6.0722	256	61.9785019	59761.616	86	0	1.0000000
12	sp.max.res.runs	6.5676	198	48.2794402	31584.373	88	2	1.0000000
5	sp.clause.del.heur	7.4106	137	25.8277566	23216.561	78	0	1.0000000
3	sp.clause.activity.inc	7.8783	144	12.0495255	12725.635	79	0	1.0000000
26	sp.var.activity.inc	8.2129	150	23.1594365	20397.472	77	0	1.0000000
22	sp.resolution	8.4059	104	22.4792527	19735.252	67	0	1.0000000
28	sp.variable.decay	8.8389	81	16.4919411	17044.369	57	0	1.0000000
25	sp.use.pure.literal.rule	8.9881	73	9.4775438	10867.184	53	0	1.0000000
4	sp.clause.decay	9.2189	87	14.9264973	14000.983	57	0	1.0000000
24	sp.update.dec.queue	10.1503	50	4.7725021	5552.966	39	0	1.0000000
6	sp.clause.inversion	11.4132	17	0.4733994	1206.508	16	0	1.0000000

Iteration 20:

	variable	mean__min_depth	no_of_nodes	mse_increase	node_purity_increase	no_of_trees	times_a_root	p_value
27	sp.var.dec.heur	1.2900	617	783.2085932	663382.462	100	33	0.0000000
13	sp.orig.clause.sort.heur	1.7200	637	524.3134477	448648.639	100	18	0.0000000
21	sp.res.order.heur	1.9300	557	532.4000764	336758.383	100	19	0.0000000
8	sp.learned.clause.sort.heur	2.4800	674	429.3700977	293306.208	100	16	0.0000000
14	sp.phase.dec.heur	2.7700	458	363.5810260	273809.424	100	4	0.0016273
2	instance	2.9500	3413	-9.7999634	36103.591	100	0	0.0000000
7	sp.first.restart	3.8646	388	132.5834707	112472.054	98	2	0.7132742
1	dummy	4.0700	852	80.2889477	78311.107	100	0	0.0000000
20	sp.res.cutoff.lits	4.2215	264	100.3742201	82197.240	95	0	1.0000000
16	sp.rand.phase.scaling	4.8038	273	113.3851581	105130.794	94	0	1.0000000
15	sp.rand.phase.dec.freq	4.9730	225	70.4829918	79531.608	90	4	1.0000000
23	sp.restart.inc	5.1669	287	114.7669603	80528.004	97	0	1.0000000
10	sp.learned.size.factor	5.5638	296	37.6379533	37375.049	94	2	1.0000000
11	sp.max.res.lit.inc	5.8730	225	82.0456598	53792.313	90	0	1.0000000
17	sp.rand.var.dec.freq	5.9330	197	80.5940627	48703.045	90	0	1.0000000
19	sp.res.cutoff.cls	5.9338	269	57.6927894	44079.267	94	0	1.0000000
9	sp.learned.clauses.inc	6.0638	233	52.6126197	36987.593	94	0	1.0000000
18	sp.rand.var.dec.scaling	6.0722	256	61.9785019	59761.616	86	0	1.0000000
12	sp.max.res.runs	6.5676	198	48.2794402	31584.373	88	2	1.0000000
5	sp.clause.del.heur	7.4106	137	25.8277566	23216.561	78	0	1.0000000
3	sp.clause.activity.inc	7.8783	144	12.0495255	12725.635	79	0	1.0000000
26	sp.var.activity.inc	8.2129	150	23.1594365	20397.472	77	0	1.0000000
22	sp.resolution	8.4059	104	22.4792527	19735.252	67	0	1.0000000
28	sp.variable.decay	8.8389	81	16.4919411	17044.369	57	0	1.0000000
25	sp.use.pure.literal.rule	8.9881	73	9.4775438	10867.184	53	0	1.0000000
4	sp.clause.decay	9.2189	87	14.9264973	14000.983	57	0	1.0000000
24	sp.update.dec.queue	10.1503	50	4.7725021	5552.966	39	0	1.0000000
6	sp.clause.inversion	11.4132	17	0.4733994	1206.508	16	0	1.0000000

The 5 most important parameters per iteration are :

```
## [[1]]
## [1] "sp.var.dec.heur"            "instance"
## [3] "sp.learned.clause.sort.heur" "sp.orig.clause.sort.heur"
## [5] "sp.first.restart"
##
## [[2]]
## [1] "sp.var.dec.heur"            "instance"
## [3] "sp.orig.clause.sort.heur"   "sp.learned.clause.sort.heur"
## [5] "sp.res.order.heur"
##
## [[3]]
## [1] "sp.var.dec.heur"            "sp.learned.clause.sort.heur"
## [3] "sp.orig.clause.sort.heur"   "instance"
##
## [[4]]
## [1] "sp.var.dec.heur"            "sp.learned.clause.sort.heur"
## [3] "instance"                   "sp.orig.clause.sort.heur"
##
## [[5]]
## [1] "sp.var.dec.heur"            "sp.learned.clause.sort.heur"
## [3] "sp.res.order.heur"          "sp.orig.clause.sort.heur"
## [5] "sp.rand.var.dec.scaling"
##
## [[6]]
## [1] "sp.var.dec.heur"          "sp.res.order.heur"
## [3] "sp.orig.clause.sort.heur" "sp.rand.var.dec.freq"
## [5] "sp.max.res.lit.inc"
##
## [[7]]
## [1] "sp.var.dec.heur"            "sp.learned.clause.sort.heur"
## [3] "sp.res.order.heur"          "sp.orig.clause.sort.heur"
```

```
## 
## [[8]]
## [1] "sp.var.dec.heur"          "sp.rand.var.dec.freq"
## [3] "sp.orig.clause.sort.heur"     "instance"
## [5] "sp.learned.clause.sort.heur"
## 
## [[9]]
## [1] "sp.var.dec.heur"          "sp.rand.var.dec.scaling"
## [3] "sp.rand.var.dec.freq"       "sp.learned.clause.sort.heur"
## [5] "sp.orig.clause.sort.heur"
## 
## [[10]]
## [1] "sp.var.dec.heur"          "sp.rand.var.dec.scaling"
## [3] "sp.rand.var.dec.freq"       "sp.learned.clause.sort.heur"
## [5] "sp.orig.clause.sort.heur"
## 
## [[11]]
## [1] "sp.var.dec.heur"          "sp.max.res.lit.inc"
## [3] "sp.learned.clause.sort.heur" "sp.res.cutoff.cls"
## [5] "sp.orig.clause.sort.heur"
## 
## [[12]]
## [1] "sp.var.dec.heur"          "sp.res.order.heur"
## [3] "sp.orig.clause.sort.heur"     "sp.learned.clause.sort.heur"
## [5] "sp.phase.dec.heur"
## 
## [[13]]
## [1] "sp.var.dec.heur"          "sp.res.cutoff.cls"
## [3] "sp.res.order.heur"         "sp.max.res.lit.inc"
## [5] "sp.learned.clause.sort.heur"
## 
## [[14]]
## [1] "sp.var.dec.heur"          "sp.res.order.heur"
## [3] "sp.orig.clause.sort.heur"     "sp.learned.clause.sort.heur"
## [5] "instance"
## 
## [[15]]
## [1] "sp.var.dec.heur"          "sp.res.order.heur"
## [3] "sp.learned.clause.sort.heur" "sp.orig.clause.sort.heur"
## [5] "sp.res.cutoff.cls"
## 
## [[16]]
## [1] "sp.max.res.lit.inc"         "sp.res.order.heur"
## [3] "sp.orig.clause.sort.heur" "sp.res.cutoff.cls"
## [5] "sp.var.dec.heur"
## 
## [[17]]
## [1] "sp.var.dec.heur"          "sp.res.order.heur"
## [3] "sp.orig.clause.sort.heur"     "sp.learned.clause.sort.heur"
## [5] "instance"
## 
## [[18]]
## [1] "sp.res.order.heur"         "sp.learned.clause.sort.heur"
## [3] "sp.orig.clause.sort.heur"     "sp.var.dec.heur"
```

```
## [5] "instance"
##
## [[19]]
## [1] "sp.var.dec.heur"            "sp.orig.clause.sort.heur"
## [3] "sp.res.order.heur"          "sp.learned.clause.sort.heur"
## [5] "sp.phase.dec.heur"
```

Parameter relevant interactions:

Iteration 1:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth
sp.orig.clause.sort.heur	sp.var.dec.heur	1.737180	106	sp.var.dec.heur:sp.orig.clause.sort.heur	1.8932
sp.learned.clause.sort.heur	sp.var.dec.heur	1.579728	115	sp.var.dec.heur:sp.learned.clause.sort.heur	1.4732

Iteration 2:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth
sp.orig.clause.sort.heur	sp.var.dec.heur	1.316947	166	sp.var.dec.heur:sp.orig.clause.sort.heur	1.3657
sp.learned.clause.sort.heur	sp.var.dec.heur	1.639579	151	sp.var.dec.heur:sp.learned.clause.sort.heur	1.7357

Iteration 3:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth

Iteration 4:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth
sp.learned.clause.sort.heur	sp.var.dec.heur	1.16092	159	sp.var.dec.heur:sp.learned.clause.sort.heur	1.62

Iteration 5:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth

Iteration 6:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth

Iteration 7:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth
sp.learned.clause.sort.heur	sp.orig.clause.sort.heur	1.0404040	197	sp.orig.clause.sort.heur:sp.learned.clause.sort.heur	1.61
sp.res.order.heur	sp.learned.clause.sort.heur	0.8484848	191	sp.learned.clause.sort.heur:sp.res.order.heur	1.58

Iteration 8:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth

Iteration 9:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth
sp.orig.clause.sort.heur	sp.var.dec.heur	1.025	185	sp.var.dec.heur:sp.orig.clause.sort.heur	1.46

Iteration 10:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth

Iteration 11:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth

Iteration 12:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth

Iteration 13:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth

Iteration 14:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth
sp.learned.clause.sort.heur	sp.var.dec.heur	1.0338	193	sp.var.dec.heur:sp.learned.clause.sort.heur	1.62
sp.orig.clause.sort.heur	sp.res.order.heur	1.0990	194	sp.res.order.heur:sp.orig.clause.sort.heur	1.49

Iteration 15:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth
sp.orig.clause.sort.heur	sp.res.order.heur	1.050505	193	sp.res.order.heur:sp.orig.clause.sort.heur	1.64

Iteration 16:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth
sp.res.order.heur	sp.var.dec.heur	0.8061224	193	sp.var.dec.heur:sp.res.order.heur	1.41
sp.orig.clause.sort.heur	sp.max.res.lit.inc	0.9661224	191	sp.max.res.lit.inc:sp.orig.clause.sort.heur	1.56

Iteration 17:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth

Iteration 18:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth
sp.learned.clause.sort.heur	sp.res.order.heur	1.242105	165	sp.res.order.heur:sp.learned.clause.sort.heur	1.51

Iteration 19:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth
sp.var.dec.heur	sp.orig.clause.sort.heur	1.111111	192	sp.orig.clause.sort.heur:sp.var.dec.heur	1.09
sp.learned.clause.sort.heur	sp.orig.clause.sort.heur	1.207071	188	sp.orig.clause.sort.heur:sp.learned.clause.sort.heur	1.57

Iteration 20:

variable	root_variable	mean_min_depth	occurrences	interaction	uncond_mean_min_depth