

## 173.applu

### Datasets profile vs. Reference Dataset

The following are the profiles for the 173.applu benchmark. For more details about our profile development and dataset reduction methodology, refer to the paper by AJ KleinOsowski and David J. Lilja, "MinneSPEC: A New SPEC Benchmark Workload for Simulation-Based Computer Architecture Research", Computer Architecture Letters, Volume 1, June 2002. This paper is available in electronic form at <http://www.arctic.umn.edu/~lilja/minnespec/index.html>



[http:// www.arctic.umn.edu](http://www.arctic.umn.edu)

**Function level execution profile at optimization level O0**

The following table contains function execution profiles and goodness-of-fit chi-squared statistic values for the train, test, large (LgRed), medium (MdRed), and small (SmRed) reduced datasets as compared to the full SPEC reference datasets. This data was gathered with the hiprof profiling utility. \*90% Conf = Critical value of the chi-squared statistic at the 90 percent confidence level. Numbers in the Ref, Train, Test, LgRed, MdRed, and SmRed columns are the percent of overall execution time spent in the stated function (in the Function column). Numbers in the Train Chi, Test Chi, LgRed Chi, MdRed Chi, and SmRed Chi are the terms of the chi-squared statistic for the stated function (in the function column).

Function	Ref	Train	Train Chi	Test	Test Chi	LgRed	LgRed Chi	MdRed	MdRed Chi	SmRed	SmRed Chi
blts_	30.60	31.60	0.03	29.50	0.04	29.60	0.03	29.00	0.08	27.80	0.26
buts_	27.10	27.30	0.00	25.60	0.08	25.20	0.13	25.30	0.12	23.10	0.59
rhs_	16.40	16.50	0.00	17.40	0.06	17.00	0.02	17.50	0.07	17.80	0.12
jacl_	12.40	12.90	0.02	13.10	0.04	12.40	0.00	13.00	0.03	11.20	0.12
jacu_	9.50	9.80	0.01	9.90	0.02	9.80	0.01	9.50	0.00	10.10	0.04
l2norm_	2.20	0.00	2.20	1.90	0.04	1.80	0.07	1.40	0.29	2.40	0.02
ssor_	1.80	1.70	0.01	1.40	0.09	1.70	0.01	1.30	0.14	2.40	0.20
erhs_	0.10	0.10	0.00	0.40	0.90	0.50	1.60	0.60	2.50	1.20	12.10
Sum	100.10	99.90	2.27	99.20	1.27	98.00	1.88	97.60	3.24	96.00	13.44
	Ref	Train	Train Chi	Test	Test Chi	LgRed	LgRed Chi	MdRed	MdRed Chi	SmRed	SmRed Chi

90% Confidence level (8 entries) = 12.017

### Function level execution profile at optimization level O1

The following table contains function execution profiles and goodness-of-fit chi-squared statistic values for the train, test, large (LgRed), medium (MdRed), and small (SmRed) reduced datasets as compared to the full SPEC reference datasets. This data was gathered with the hiprof profiling utility. \*90% Conf = Critical value of the chi-squared statistic at the 90 percent confidence level. Numbers in the Ref, Train, Test, LgRed, MdRed, and SmRed columns are the percent of overall execution time spent in the stated function (in the Function column). Numbers in the Train Chi, Test Chi, LgRed Chi, MdRed Chi, and SmRed Chi are the terms of the chi-squared statistic for the stated function (in the function column).

Function	Ref	Train	Train Chi	Test	Test Chi	LgRed	LgRed Chi	MdRed	MdRed Chi	SmRed	SmRed Chi
buts_	33.80	35.50	0.09	34.30	0.01	33.80	0.00	32.40	0.06	33.80	0.00
blts_	33.70	35.90	0.14	33.30	0.00	33.60	0.00	32.70	0.03	29.90	0.43
rhs_	16.30	16.10	0.00	15.90	0.01	16.50	0.00	15.80	0.02	16.90	0.02
jacl_	5.80	5.60	0.01	5.30	0.04	4.70	0.21	6.00	0.01	5.20	0.06
jacu_	4.20	4.20	0.00	3.50	0.12	3.20	0.24	3.30	0.19	1.30	2.00
l2norm_	3.50	0.00	3.50	4.10	0.10	3.10	0.05	3.00	0.07	0.00	3.50
ssor_	2.70	2.50	0.01	1.50	0.53	1.60	0.45	1.80	0.30	0.00	2.70
erhs_	0.10	0.10	0.00	0.50	1.60	0.70	3.60	0.50	1.60	0.00	0.10
Sum	100.10	99.90	3.75	98.40	2.42	97.20	4.54	95.50	2.27	87.10	8.82
	Ref	Train	Train Chi	Test	Test Chi	LgRed	LgRed Chi	MdRed	MdRed Chi	SmRed	SmRed Chi

90% Confidence level (8 entries) = 12.017

## Function level execution profile at optimization level O2

The following table contains function execution profiles and goodness-of-fit chi-squared statistic values for the train, test, large (LgRed), medium (MdRed), and small (SmRed) reduced datasets as compared to the full SPEC reference datasets. This data was gathered with the hiprof profiling utility. \*90% Conf = Critical value of the chi-squared statistic at the 90 percent confidence level. Numbers in the Ref, Train, Test, LgRed, MdRed, and SmRed columns are the percent of overall execution time spent in the stated function (in the Function column). Numbers in the Train Chi, Test Chi, LgRed Chi, MdRed Chi, and SmRed Chi are the terms of the chi-squared statistic for the stated function (in the function column).

Function	Ref	Train	Train Chi	Test	Test Chi	LgRed	LgRed Chi	MdRed	MdRed Chi	SmRed	SmRed Chi
blts_	25.40	28.90	0.48	25.00	0.01	26.60	0.06	28.10	0.29	29.60	0.69
butts_	24.70	26.30	0.10	24.50	0.00	23.40	0.07	24.80	0.00	14.80	3.97
rhs_	16.40	14.50	0.22	20.60	1.08	15.10	0.10	19.80	0.70	14.80	0.16
jacl_	15.70	15.70	0.00	13.00	0.46	13.00	0.46	6.60	5.27	3.70	9.17
jacu_	11.80	12.00	0.00	11.50	0.01	8.90	0.71	5.80	3.05	0.00	11.80
l2norm_	3.00	0.00	3.00	1.20	1.08	2.60	0.05	2.50	0.08	0.00	3.00
ssor_	2.90	2.30	0.12	0.20	2.51	2.60	0.03	2.50	0.06	0.00	2.90
erhs_	0.10	0.10	0.00	0.50	1.60	0.50	1.60	0.80	4.90	0.00	0.10
Sum	100.00	99.80	3.93	96.50	6.75	92.70	3.09	90.90	14.36	62.90	31.79
	Ref	Train	Train Chi	Test	Test Chi	LgRed	LgRed Chi	MdRed	MdRed Chi	SmRed	SmRed Chi

90% Confidence level (8 entries) = 12.017

### Function level execution profile at optimization level O3

The following table contains function execution profiles and goodness-of-fit chi-squared statistic values for the train, test, large (LgRed), medium (MdRed), and small (SmRed) reduced datasets as compared to the full SPEC reference datasets. This data was gathered with the hiprof profiling utility. \*90% Conf = Critical value of the chi-squared statistic at the 90 percent confidence level. Numbers in the Ref, Train, Test, LgRed, MdRed, and SmRed columns are the percent of overall execution time spent in the stated function (in the Function column). Numbers in the Train Chi, Test Chi, LgRed Chi, MdRed Chi, and SmRed Chi are the terms of the chi-squared statistic for the stated function (in the function column).

Function	Ref	Train	Train Chi	Test	Test Chi	LgRed	LgRed Chi	MdRed	MdRed Chi	SmRed	SmRed Chi
blts_	29.90	31.60	0.10	26.70	0.34	25.00	0.80	21.70	2.25	10.70	12.33
buts_	29.70	28.60	0.04	23.10	1.47	20.20	3.04	16.00	6.32	17.90	4.69
rhs_	13.90	12.80	0.09	14.90	0.07	16.10	0.35	16.00	0.32	14.30	0.01
jacl_	12.20	14.00	0.27	14.90	0.60	14.30	0.36	13.20	0.08	7.10	2.13
jacu_	9.80	11.00	0.15	10.90	0.12	9.50	0.01	13.20	1.18	0.00	9.80
ssor_	2.50	1.80	0.20	1.50	0.40	0.00	2.50	0.90	1.02	3.60	0.48
l2norm_	2.00	0.00	2.00	0.90	0.61	1.80	0.02	1.90	0.01	0.00	2.00
Sum	100.00	99.80	2.83	92.90	3.61	86.90	7.08	82.90	11.18	53.60	31.44
	Ref	Train	Train Chi	Test	Test Chi	LgRed	LgRed Chi	MdRed	MdRed Chi	SmRed	SmRed Chi

90% Confidence level (7 entries) = 10.645

### Function level execution profile at optimization level O4

The following table contains function execution profiles and goodness-of-fit chi-squared statistic values for the train, test, large (LgRed), medium (MdRed), and small (SmRed) reduced datasets as compared to the full SPEC reference datasets. This data was gathered with the hiprof profiling utility. \*90% Conf = Critical value of the chi-squared statistic at the 90 percent confidence level. Numbers in the Ref, Train, Test, LgRed, MdRed, and SmRed columns are the percent of overall execution time spent in the stated function (in the Function column). Numbers in the Train Chi, Test Chi, LgRed Chi, MdRed Chi, and SmRed Chi are the terms of the chi-squared statistic for the stated function (in the function column).

Function	Ref	Train	Train Chi	Test	Test Chi	LgRed	LgRed Chi	MdRed	MdRed Chi	SmRed	SmRed Chi
buts_	30.30	29.50	0.02	23.50	1.53	21.10	2.79	20.40	3.23	20.00	3.50
blts_	29.60	31.60	0.14	26.20	0.39	23.40	1.30	22.30	1.80	4.00	22.14
rhs_	13.50	11.90	0.19	14.00	0.02	14.00	0.02	14.60	0.09	20.00	3.13
jacl_	12.40	14.10	0.23	16.20	1.16	14.00	0.21	12.60	0.00	4.00	5.69
jacu_	9.70	10.80	0.12	11.60	0.37	10.50	0.07	9.70	0.00	4.00	3.35
ssor_	2.60	2.00	0.14	1.50	0.47	1.80	0.25	1.00	0.98	0.00	2.60
l2norm_	2.00	0.00	2.00	1.80	0.02	1.20	0.32	1.00	0.50	4.00	2.00
Sum	100.10	99.90	2.84	94.80	3.96	86.00	4.95	81.60	6.61	56.00	42.41
	Ref	Train	Train Chi	Test	Test Chi	LgRed	LgRed Chi	MdRed	MdRed Chi	SmRed	SmRed Chi

90% Confidence level (7 entries) = 10.645

### Instruction Mix profile at optimization level o0

The following table contains instruction mix breakdown and goodness-of-fit chi-squared statistic values for the train, test, large (LgRed), medium (MdRed), and small (SmRed) reduced datasets, as compared to the full SPEC dataset. This data was gathered with the sim-profile simulator for the SimpleScalar suite. \*90% Conf = Critical value of the chi-squared statistic at the 90 percent confidence level. Numbers in the Ref, Train, Test, LgRed, MdRed, and SmRed columns are the percent of overall instructions of the stated instruction type (in the Inst Type column). Numbers in the Train Chi, Test Chi, LgRed Chi, MdRed Chi, and SmRed Chi columns are the terms of the chi-squared statistic for the stated instruction type (in the Inst Type column).

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O0 Program

Inst Type	Ref	Train	Train Chi	Test	Test Chi	Lgred	Lgred Chi	Mdred	Mdred Chi	Smred	Smred Chi
load	48.08	48.08	0.00	48.12	0.00	48.11	0.00	48.10	0.00	48.04	0.00
store	2.47	2.46	0.00	2.51	0.00	2.53	0.00	2.54	0.00	2.62	0.01
unconditional branch	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.04	0.00
conditional branch	0.91	0.90	0.00	0.93	0.00	0.94	0.00	0.96	0.00	1.03	0.02
int computation	42.13	42.11	0.00	42.00	0.00	41.97	0.00	41.94	0.00	41.79	0.00
fp computation	6.40	6.45	0.00	6.44	0.00	6.44	0.00	6.44	0.00	6.47	0.00
trap	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum	99.99	100.00	0.00	100.00	0.00	100.00	0.00	99.99	0.01	99.99	0.03
	Ref	Train	Train Chi	Test	Test Chi	Lgred	Lgred Chi	Mdred	Mdred Chi	Smred	Smred Chi

90% Confidence level (7 entries) = 10.645

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### **Instruction Mix profile at optimization level o1**

The following table contains instruction mix breakdown and goodness-of-fit chi-squared statistic values for the train, test, large (LgRed), medium (MdRed), and small (SmRed) reduced datasets, as compared to the full SPEC dataset. This data was gathered with the sim-profile simulator for the SimpleScalar suite. \*90% Conf = Critical value of the chi-squared statistic at the 90 percent confidence level. Numbers in the Ref, Train, Test, LgRed, MdRed, and SmRed columns are the percent of overall instructions of the stated instruction type (in the Inst Type column). Numbers in the Train Chi, Test Chi, LgRed Chi, MdRed Chi, and SmRed Chi columns are the terms of the chi-squared statistic for the stated instruction type (in the Inst Type column).

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O1 Program

Inst Type	Ref	Train	Train Chi	Test	Test Chi	Lgred	Lgred Chi	Mdred	Mdred Chi	Smred	Smred Chi
load	25.97	25.93	0.00	25.97	0.00	25.97	0.00	25.97	0.00	26.04	0.00
store	7.16	7.18	0.00	7.20	0.00	7.22	0.00	7.24	0.00	7.29	0.00
unconditional branch	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.03	0.00	0.10	0.00
conditional branch	2.49	2.46	0.00	2.52	0.00	2.55	0.00	2.58	0.00	2.74	0.03
int computation	49.61	49.43	0.00	49.48	0.00	49.46	0.00	49.43	0.00	49.18	0.00
fp computation	14.77	15.00	0.00	14.82	0.00	14.78	0.00	14.74	0.00	14.65	0.00
trap	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum	100.00	100.00	0.00	100.00	0.00	100.00	0.00	99.99	0.00	100.00	0.03
	Ref	Train	Train Chi	Test	Test Chi	Lgred	Lgred Chi	Mdred	Mdred Chi	Smred	Smred Chi

90% Confidence level (7 entries) = 10.645

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### **Instruction Mix profile at optimization level o2**

The following table contains instruction mix breakdown and goodness-of-fit chi-squared statistic values for the train, test, large (LgRed), medium (MdRed), and small (SmRed) reduced datasets, as compared to the full SPEC dataset. This data was gathered with the sim-profile simulator for the SimpleScalar suite. \*90% Conf = Critical value of the chi-squared statistic at the 90 percent confidence level. Numbers in the Ref, Train, Test, LgRed, MdRed, and SmRed columns are the percent of overall instructions of the stated instruction type (in the Inst Type column). Numbers in the Train Chi, Test Chi, LgRed Chi, MdRed Chi, and SmRed Chi columns are the terms of the chi-squared statistic for the stated instruction type (in the Inst Type column).

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O2 Program

Inst Type	Ref	Train	Train Chi	Test	Test Chi	Lgred	Lgred Chi	Mdred	Mdred Chi	Smred	Smred Chi
load	21.71	21.75	0.00	21.62	0.00	21.62	0.00	21.64	0.00	21.79	0.00
store	8.90	8.95	0.00	9.01	0.00	9.06	0.00	9.09	0.00	9.15	0.01
unconditional branch	0.00	0.00	0.00	0.02	0.00	0.05	0.00	0.07	0.00	0.21	0.00
conditional branch	5.51	5.42	0.00	5.54	0.00	5.58	0.00	5.61	0.00	5.82	0.02
int computation	33.86	33.57	0.00	33.69	0.00	33.75	0.00	33.80	0.00	34.04	0.00
fp computation	30.02	30.32	0.00	30.11	0.00	29.95	0.00	29.79	0.00	28.99	0.04
trap	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Sum	100.00	100.01	0.01	99.99	0.00	100.01	0.00	100.00	0.01	100.01	0.06
	Ref	Train	Train Chi	Test	Test Chi	Lgred	Lgred Chi	Mdred	Mdred Chi	Smred	Smred Chi

90% Confidence level (7 entries) = 10.645

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### **Instruction Mix profile at optimization level o3**

The following table contains instruction mix breakdown and goodness-of-fit chi-squared statistic values for the train, test, large (LgRed), medium (MdRed), and small (SmRed) reduced datasets, as compared to the full SPEC dataset. This data was gathered with the sim-profile simulator for the SimpleScalar suite. \*90% Conf = Critical value of the chi-squared statistic at the 90 percent confidence level. Numbers in the Ref, Train, Test, LgRed, MdRed, and SmRed columns are the percent of overall instructions of the stated instruction type (in the Inst Type column). Numbers in the Train Chi, Test Chi, LgRed Chi, MdRed Chi, and SmRed Chi columns are the terms of the chi-squared statistic for the stated instruction type (in the Inst Type column).

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O3 Program

Inst Type	Ref	Train	Train Chi	Test	Test Chi	Lgred	Lgred Chi	Mdred	Mdred Chi	Smred	Smred Chi
load	26.21	26.12	0.00	25.92	0.00	25.85	0.00	26.00	0.00	25.91	0.00
store	11.28	11.32	0.00	11.23	0.00	11.28	0.00	11.28	0.00	11.20	0.00
unconditional branch	0.00	0.00	0.00	0.03	0.00	0.06	0.00	0.09	0.00	0.26	0.00
conditional branch	4.39	4.45	0.00	4.59	0.01	4.66	0.02	4.77	0.03	5.13	0.12
int computation	20.26	20.40	0.00	20.58	0.01	20.84	0.02	21.13	0.04	22.35	0.22
fp computation	37.88	37.72	0.00	37.66	0.00	37.31	0.01	36.72	0.04	35.13	0.20
trap	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Sum	100.02	100.01	0.00	100.01	0.02	100.00	0.05	99.99	0.11	99.99	0.54
	Ref	Train	Train Chi	Test	Test Chi	Lgred	Lgred Chi	Mdred	Mdred Chi	Smred	Smred Chi

90% Confidence level (7 entries) = 10.645

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**Instruction Mix profile at optimization level o4**

The following table contains instruction mix breakdown and goodness-of-fit chi-squared statistic values for the train, test, large (LgRed), medium (MdRed), and small (SmRed) reduced datasets, as compared to the full SPEC dataset. This data was gathered with the sim-profile simulator for the SimpleScalar suite. \*90% Conf = Critical value of the chi-squared statistic at the 90 percent confidence level. Numbers in the Ref, Train, Test, LgRed, MdRed, and SmRed columns are the percent of overall instructions of the stated instruction type (in the Inst Type column). Numbers in the Train Chi, Test Chi, LgRed Chi, MdRed Chi, and SmRed Chi columns are the terms of the chi-squared statistic for the stated instruction type (in the Inst Type column).

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O4 Program

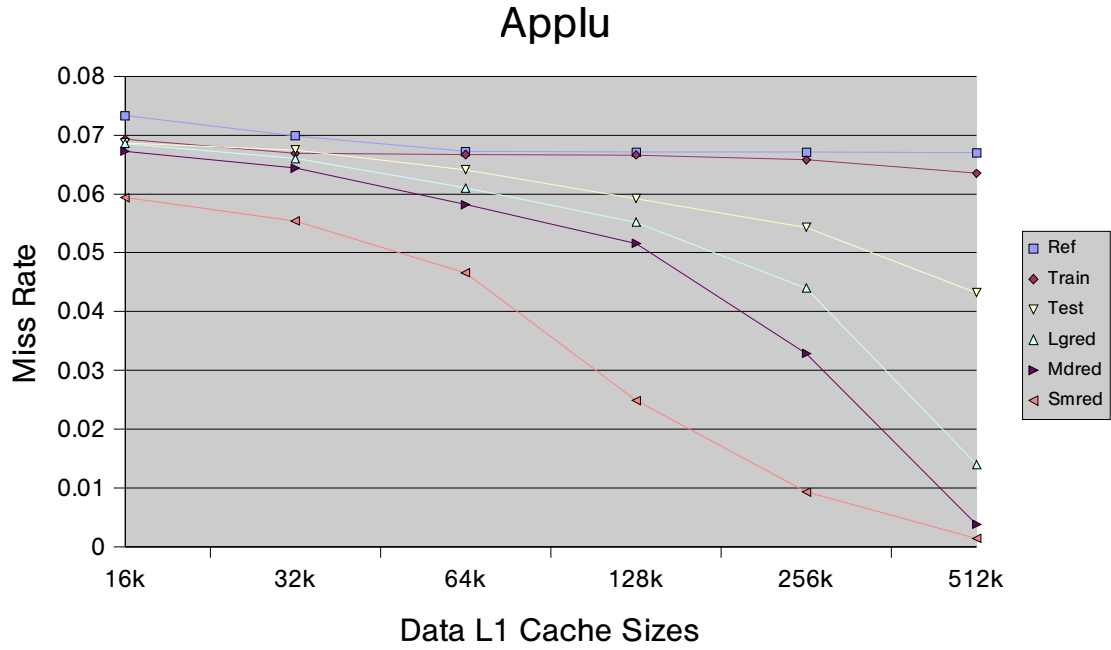
Inst Type	Ref	Train	Train Chi	Test	Test Chi	Lgred	Lgred Chi	Mdred	Mdred Chi	Smred	Smred Chi
load	26.21	26.12	0.00	25.92	0.00	25.85	0.00	26.00	0.00	25.91	0.00
store	11.28	11.32	0.00	11.23	0.00	11.28	0.00	11.28	0.00	11.20	0.00
unconditional branch	0.00	0.00	0.00	0.03	0.00	0.06	0.00	0.09	0.00	0.26	0.00
conditional branch	4.39	4.45	0.00	4.59	0.01	4.66	0.02	4.77	0.03	5.13	0.12
int computation	20.26	20.40	0.00	20.58	0.01	20.84	0.02	21.13	0.04	22.35	0.22
fp computation	37.88	37.72	0.00	37.66	0.00	37.31	0.01	36.72	0.04	35.13	0.20
trap	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Sum	100.02	100.01	0.00	100.01	0.02	100.00	0.05	99.99	0.11	99.99	0.54
	Ref	Train	Train Chi	Test	Test Chi	Lgred	Lgred Chi	Mdred	Mdred Chi	Smred	Smred Chi

90% Confidence level (7 entries) = 10.645

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## Cache profile

The following chart shows level 1 data cache miss rates for the Ref, Train, Test, LgRed, MdRed, and SmRed datasets. This data was gathered with the sim-cache simulator from the SimpleScalar suite. Miss rate is stated as the ratio of level 1 misses to total level 1 accesses.



### ***Instruction Counts for all Datasets***

The following table shows the instruction counts and estimated simulation time for the reference (Ref), train, test, large (LgRed), medium(MdRed), and small (SmRed) reduced datasets. Instruction counts are from the simulated benchmark, compiled at optimization level O0 and run with each input dataset. Estimated simulation times are calculated using a 45,000 instructions per second factor. This factor was determined by observing the simulation rate of a simulator similar to sim-outorder, run on a machine similar to the SPEC 2000 reference machine (a 333 Mhz Sparc).

	<u>Ref</u>	<u>Train</u>	<u>Test</u>	<u>LgRed</u>	<u>MdRed</u>	<u>SmRed</u>
Instruction Count						
(in millions)	2706994	104158	2013	952	557	104
Simulation Time						
(in hours)	16709.8	642.9	12.4	5.9	3.4	0.6