Run-time Evaluation of Object Inlining Opportunities in Java

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1 Introduction

Object-oriented programs organize data in objects linked together with pointers. While this enhances modularity, making programs easier to understand and maintain, it has a run-time cost due to the pointers that must be dereferenced to access the data.

The purpose of object inlining is to find sets of objects which can be efficiently fused into larger objects, and to fuse them. This reduces the time and space overhead associated with pointers, because pointers between objects which are fused together are no longer needed; the pointers are said to be *inlined*.

In C++, the programmer may explicitly request that an object be inlined into another by including the child object (rather than a pointer to it) as a field inside the parent. The child object then becomes part of the parent object. In Java, this is not allowed; fields can only contain references to non-primitive objects, not the objects themselves. Even in C++, the burden of specifying which objects are to be inlined is on the programmer, rather than the compiler.

Existing work describes static analyses and transformations for finding inlinable pointers and inlining them. In contrast, this study examines run-time data about pointers which could be inlined. It therefore gives an upper bound on the amount of inlining possible, no matter how precise a compiler analysis is used.

2 Related work

Most of the existing work on object inlining is by Dolby and Chien [1, 2, 3]. They give a definition of dynamic one-to-one fields, and give a proof that inlining one-to-one fields preserves semantics. They also give a compiler analysis for finding one-to-one fields. They implement their analysis in ICC, a compiler for a language similar to both Java and C++, and evaluate its cost and effectiveness. They also measure the speedup of several C++ benchmarks ported to their compiler.

Peeter Laud [4] gives a slightly different definition of inlinable fields.

3 Definitions

This study compares two definitions of inlinable fields from the related work. Although many fields are inlinable according to both definitions, some fields are inlinable only according to Dolby and Chien's definition, and some other fields are inlinable only according to Laud's definition.

3.1 Dolby and Chien's definition

A *dynamic one-to-one field*, as defined in [3], is a field for which, in a given execution of a program, each parent object corresponds to exactly one child object through the field, and vice-versa. The precise definition is easier to understand if we present the restrictions which *prevent* a field from being one-to-one, rather than the conditions which make it one-to-one. So, define every field of reference type to be one-to-one unless it satisfies either of the following:

1. Field `f` is not one-to-one if more than one child object corresponds to the same parent through it. That is, if `p.f == c` at one point in the program, and `p.f == d` at some other point, and `c` and `d` are distinct objects, then `f` is not one-to-one.

2. Field `f` is not one-to-one if more than one parent object refers to the same child object through it. That is, if there is some child object `c` such that `p.f == c` at some point in the execution of the program, and `q.f == c` at some point, where `p` and `q` are distinct objects, then `f` is not one-to-one. Note that in order for this restriction to prevent a field from being one-to-one, both parent objects must refer to the child through the *same field*. For example, if `p.f == c` and `q.g == c`, this does not prevent `f` or `g` from being one-to-one, contrary to what is wrongly claimed in [4].

A one-to-one field is inlined by adding the contents of the child class to the parent class, and replacing any uses of the child objects with the parent objects. The child object is never explicitly allocated; its space becomes a part of the parent object. The paper proves that if such a field is inlined in this way, the semantics of the program will be unchanged.

3.2 Laud's definition

Laud's definition [4] lifts the first restriction on inlinable fields, but strengthens the second restriction. Under Laud's definition [4], a field is inlinable if every child object that is stored into it is not stored into any other field of any object. Again, we can make the definition easier to understand by explaining the restriction that makes a field not inlinable. Every field of reference type is inlinable unless it satisfies the following:

1. Field `f` is not inlinable if there is a child object `c` that is stored into some parent object `p` through `f`, and `c` is also stored anywhere other than in `p.f`. For example, if `c` were also stored into `q.f` or into `p.g` (assuming `p` and `q` are distinct, as are `f` and `g`), then `f` would not be inlinable.

An inlinable field according to Laud's definition is inlined by adding the contents of the child class to the parent class, and replacing all stores into the field with copies of the child object into the fields that were added into the parent.

3.3 Combined definition

The two definitions can be combined. The set of fields inlinable according to the combined definition is the union of the sets of fields inlinable according to the two previous definitions. Every field of reference type is inlinable under the combined definition in the absence of the following restrictions:

- Field `f` is not inlinable if more than one parent object refers to the same child object through it at some point or points in the execution of the program.

- Field `f` is not inlinable if more than one child object corresponds to the same parent through `f` **AND** some child object stored in `f` is also stored in some other field `g`.

Because every field inlinable according to the combined definition is inlinable according to at least one of the previous two definitions, it can be inlined using the inlining procedure specified for that definition.

4   Examples

I now give four examples showing fields inlinable according to both, neither, only Dolby and Chien's, and only Laud's definition.

4.1   Field inlinable according to both definitions

$$p \xrightarrow{f} c \qquad q \xrightarrow{f} d$$
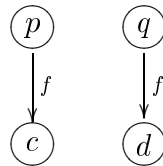
The field f could be inlined using either definition, making c and d become part of p and q, respectively:

$$\binom{p}{c} \qquad \binom{q}{d}$$
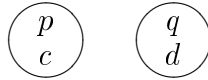
4.2   Field not inlinable according to either definition

$$p \xrightarrow{f} c \xleftarrow{f} q$$
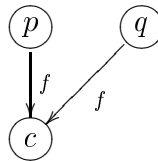
In this example, f cannot be inlined according to either definition because the child c corresponds to two different parents p and q through it.

4.3   Fields inlinable only according to Dolby and Chien's definition

$$p \xrightarrow{f} c \xleftarrow{g} q$$
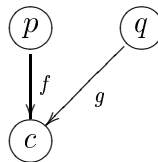
In this example, the fields f and g cannot be inlined according to Laud's definition, because the child c stored in them is stored into more than one field. However, both fields can be inlined

according to Dolby and Chien's definition. Assume the field f were inlined first, moving c into p, and changing all references to c (specifically, the field g in q) into references to p:
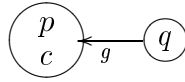
Finally, the field g could be inlined by moving p into q:
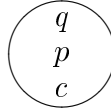
4.4 Field inlinable only according to Laud's definition
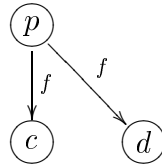
In this example, f is not inlinable according to Dolby and Chien's definition, because p refers to two children through it (at different points in the execution of the program). However, this field is inlinable according to Laud's definition. It would be inlined by moving the contents of c into p, and changing the field write that overwrites the pointer to c with the pointer to d with a copy of the contents of d (overwriting c).

5   Experiment

I modified version 1.0.6 of the Kaffe virtual machine to trace object allocations and field reads and writes. Kaffe uses a mark and sweep garbage collector so the address of an object never changes. However, the address of an object is not sufficient to uniquely identify the object, because a new object can be created at the same address as an older object that has been reclaimed by the garbage collector. For this reason, the tracing code assigns a unique identifier to each object when it is created so that the object can later be recognized. These identifiers are stored separately from the Java heap to avoid any unexpected interactions with the benchmark code. For each field write executed, the tracing code outputs an identifier for the field being written, and identifiers for the parent and child objects. Also, for each field, the trace records the number of reads that occurred through that field.

I analyzed the traces of field writes to identify the inlinable fields according to each of the two definitions. An outline of the algorithm to do this is given below:

1. Remove duplicate entries (writes of the same child to the same parent through the same field) from the list of field writes.

2. For any pair of entries with the same field and child, but different parent, add the field to a set of fields not inlinable according to Dolby and Chien's definition.

3. For any pair of entries with the same field and parent, but different child, add the field to a set of fields not inlinable according to Dolby and Chien's definition.

4. For any pair of entries with the same child but different field or different parent, add the field(s) to a set of fields not inlinable according to Laud's definition.

5. Report all fields not in the sets of non-inlinable fields as inlinable.

For each inlinable field, I determined the number of reads and writes to it, as well as the number of unique child objects written to it. This gives an indication of how much the program could be optimized by inlining the field.

- All reads of an inlinable field (according to either definition) would be removed if the field were inlined, hopefully speeding up the program.

- For each write to a field inlinable according to Dolby and Chien's method, the field write and the allocation of the child object would be removed if the field were inlined, hopefully speeding up the program.

- For each write to a field inlinable according to Laud's method, the field write would be replaced by a copy of the fields of the child object to fields in the parent object. If the child object contained at least one field, this would be likely to slow the program down.

- Finally, for each inlinable field write (according to either definition), the amount of memory required to store a pointer to the child object would be saved.

I ran my experiment on sixteen benchmarks from the SPECjvm suite and the Ashes hard test suite. I was unable to run the mpegaudio, mtrt or javac benchmarks from the SPECjvm suite successfully, even on an unmodified version of the Kaffe virtual machine.

6 Results

The appendix lists all the fields found to be inlinable for each benchmark.

The following table shows the number of fields in each benchmark that were found to be inlinable according to Dolby and Chien's definition, according to Laud's definition, and according to the combine definition. It also shows the number of field reads, field writes, and child object allocations that could be eliminated in a run of the benchmark if all the inlinable fields were inlined. For each of these numbers, the table includes the percentage of the total number of pointer-valued fields reads or writes, or of the total number of objects allocated that this represents.

		static	dynamic					
	defini-	inlinable			eliminatable			
benchmark	tion	fields	field reads		field writes		allocations	
boyer	Laud	21	650963	21.1%	35804	2.9%	35804	6.7%
	Dolby	25	844712	27.4%	36116	2.9%	36116	6.7%
	combined	28	845097	27.4%	36128	2.9%	36128	6.7%
check	Laud	24	16186	44.3%	276	12.8%	276	11.0%
	Dolby	25	16128	44.1%	332	15.4%	324	12.9%
	combined	28	16324	44.7%	351	16.3%	343	13.7%
compress	Laud	39	892950164	87.2%	709	10.5%	684	21.3%
	Dolby	48	1024176873	100.0%	999	14.7%	916	28.5%
	combined	51	1024183837	100.0%	1031	15.2%	948	29.5%
db	Laud	35	55066087	15.6%	16593	0.5%	16593	0.5%
	Dolby	45	51084081	14.5%	16541	0.5%	16533	0.5%
	combined	50	106068877	30.1%	32326	1.0%	32318	1.0%
decode	Laud	25	25358	54.0%	719	26.6%	719	0.0%
	Dolby	26	24274	51.7%	773	28.6%	765	0.0%
	combined	30	26186	55.8%	799	29.5%	791	0.0%
fft	Laud	29	14856	46.1%	129	9.1%	129	10.1%
	Dolby	32	14416	44.7%	192	13.5%	184	14.4%
	combined	35	15094	46.8%	211	14.9%	203	15.9%
illness	Laud	17	10625364	68.8%	55	10.7%	55	14.4%
	Dolby	18	10625069	68.7%	64	12.4%	64	16.8%
	combined	21	10625454	68.8%	76	14.7%	76	19.9%
jack	Laud	51	68725554	49.5%	3837356	23.5%	3285094	20.6%
	Dolby	75	24040835	17.3%	1690464	10.3%	1690456	10.6%
	combined	83	77312577	55.7%	3876290	23.7%	3324020	20.9%
jess	Laud	69	98563469	86.9%	2606226	65.2%	2606226	32.9%
	Dolby	83	46184075	40.7%	2533739	63.4%	2533731	32.0%
	combined	91	104183026	91.9%	3245165	81.1%	3245157	41.0%
lexgen	Laud	29	202668	1.4%	2496	0.1%	2496	0.1%
	Dolby	29	133112	0.9%	1387	0.0%	1387	0.1%
	combined	39	203309	1.4%	3296	0.1%	3296	0.2%
lu	Laud	29	14888	46.1%	133	9.3%	133	10.2%
	Dolby	32	14444	44.7%	196	13.8%	188	14.4%
	combined	35	15130	46.8%	215	15.1%	207	15.9%
machineSim	Laud	38	356497	72.6%	393	1.4%	393	1.0%
	Dolby	54	363172	73.9%	468	1.6%	460	1.1%
	combined	57	364054	74.1%	490	1.7%	482	1.2%
matrix	Laud	26	52676505	100.0%	523	20.2%	523	13.0%
	Dolby	28	52675676	100.0%	585	22.6%	577	14.3%
	combined	31	52677135	100.0%	603	23.3%	595	14.7%
probe	Laud	26	77680	0.9%	1903	0.1%	1903	0.0%
	Dolby	28	76348	0.9%	1965	0.1%	1957	0.0%
	combined	31	78810	0.9%	1983	0.1%	1975	0.0%
puzzle	Laud	29	18444	3.0%	220	11.6%	220	2.6%
	Dolby	32	17989	2.9%	266	14.0%	258	3.1%
	combined	35	18753	3.0%	305	16.1%	297	3.5%
raytrace	Laud	57	97559152	76.2%	376173	35.1%	376171	5.9%
	Dolby	64	102740748	80.3%	553431	51.6%	553421	8.7%
	combined	67	102748238	80.3%	553459	51.6%	553449	8.7%

The table on the next page presents the same numbers as the previous one, but restricted to inlinable fields of non-array type. I focus on these fields because fields of array type are difficult to inline, unless the size of the array can be determined before run-time.

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benchmark	definition	static inlinable fields	dynamic eliminatable field reads		field writes		allocations	
boyer	Laud	15	644109	20.9%	35786	2.9%	35786	6.7%
	Dolby	20	838243	27.2%	36104	2.9%	36104	6.7%
	combined	22	838243	27.2%	36110	2.9%	36110	6.7%
check	Laud	16	1141	3.1%	76	3.5%	76	3.0%
	Dolby	18	1279	3.5%	145	6.7%	137	5.5%
	combined	20	1279	3.5%	151	7.0%	143	5.7%
compress	Laud	25	459384803	44.9%	381	5.6%	356	11.1%
	Dolby	32	459385891	44.9%	587	8.7%	504	15.7%
	combined	34	459385891	44.9%	598	8.8%	515	16.0%
db	Laud	20	42810	0.0%	179	0.0%	179	0.0%
	Dolby	32	51045486	14.5%	15804	0.5%	15796	0.5%
	combined	35	51045600	14.5%	15912	0.5%	15904	0.5%
decode	Laud	16	3770	8.0%	76	2.8%	76	0.0%
	Dolby	19	4598	9.8%	150	5.5%	142	0.0%
	combined	21	4598	9.8%	156	5.8%	148	0.0%
fft	Laud	17	126	0.4%	77	5.4%	77	6.0%
	Dolby	21	364	1.1%	153	10.8%	145	11.3%
	combined	23	364	1.1%	159	11.2%	151	11.8%
illness	Laud	9	6881438	44.5%	17	3.3%	17	4.5%
	Dolby	11	6881528	44.5%	32	6.2%	32	8.4%
	combined	13	6881528	44.5%	38	7.4%	38	9.9%
jack	Laud	35	17114916	12.3%	2058372	12.6%	1506110	9.5%
	Dolby	61	20975327	15.1%	1393804	8.5%	1393796	8.7%
	combined	66	25684871	18.5%	2097305	12.8%	1545035	9.7%
jess	Laud	46	4759846	4.2%	500	0.0%	500	0.0%
	Dolby	66	10379403	9.2%	639432	16.0%	639424	8.1%
	combined	68	10379403	9.2%	639439	16.0%	639431	8.1%
lexgen	Laud	23	102899	0.7%	2472	0.1%	2472	0.1%
	Dolby	23	33431	0.2%	1070	0.0%	1070	0.1%
	combined	32	103241	0.7%	2973	0.1%	2973	0.1%
lu	Laud	17	154	0.5%	77	5.4%	77	5.9%
	Dolby	21	396	1.2%	153	10.8%	145	11.1%
	combined	23	396	1.2%	159	11.2%	151	11.6%
machineSim	Laud	21	23669	4.8%	86	0.3%	86	0.2%
	Dolby	38	31226	6.4%	174	0.6%	166	0.4%
	combined	40	31226	6.4%	183	0.6%	175	0.4%
matrix	Laud	16	2898	0.0%	76	2.9%	76	1.9%
	Dolby	19	3528	0.0%	150	5.8%	142	3.5%
	combined	21	3528	0.0%	156	6.0%	148	3.7%
probe	Laud	17	5493	0.1%	962	0.0%	962	0.0%
	Dolby	20	6623	0.1%	1036	0.0%	1028	0.0%
	combined	22	6623	0.1%	1042	0.0%	1034	0.0%
puzzle	Laud	17	911	0.1%	116	6.1%	116	1.4%
	Dolby	21	1220	0.2%	175	9.2%	167	2.0%
	combined	23	1220	0.2%	201	10.6%	193	2.3%
raytrace	Laud	40	24692670	19.3%	160266	14.9%	160266	2.5%
	Dolby	48	29881756	23.3%	337545	31.5%	337537	5.3%
	combined	50	29881756	23.3%	337552	31.5%	337544	5.3%

7   Discussion

The percentage of field reads that could be eliminated by inlining varies greatly depending on the benchmark, from 0.9% for probe, to 100.0% for matrix. Ignoring fields of array type, this percentage only reaches 44.9% in compress, suggesting that many inlinable fields are in fact arrays, which are difficult to inline. Dolby and Chien's definition tends to find more inlinable fields of non-array type accounting for more field reads than Laud's definition, while Laud's definition tends to work better if fields of array type are also considered. However, there is no reason not to use the combined definition to find fields to inline, and doing this finds strictly

more inlinable fields in every benchmark than either one of the definitions on its own.

Examination of the most important inlinable fields in the various benchmarks revealed that in many cases, child objects are only assigned to them in the constructor of the parent. These fields could be detected even by a much less sophisticated compiler analysis than the one presented by Dolby and Chien. In a few cases, the fields are even declared private, so the compiler would not even have to analyze the whole program to find them.

In order to study the performance improvements attainable by inlining fields, I manually inlined the inlinable fields of non-array type in compress. I chose compress because it has the highest absolute as well as relative number of field reads removable by inlining. Jack would also have been interesting to study, because it has the highest number of field writes and object allocations removable by inlining. However, the most important inlinable fields in jack are of type Vector and HashMap from the standard Java library, making them difficult to inline by hand.

Compress has a very simple object hierarchy, with classes being used to group data, but with no complex relationships between objects. Seven fields (`de_stack`, `tab_suffix`, and `tab_prefix` in `Decompressor`, `Output` and `Input` in `Comp_Base`, and `htab` and `codetab` in `Compressor`) account for over 99.9995% of the reads of inlinable fields, so I only inlined these seven fields. I compared the resulting benchmark to the original on versions 1.2.2 and 1.3.1 of the Sun Java Virtual Machine on both an Intel Pentium II at 333 MHz, and a Sun UltraSPARC-III at 750 MHz, as well as on version 1.3.0 of the IBM Virtual Machine on the Intel machine. The following table shows the speedups due to inlining, averaged over five runs of the benchmark on each platform:

Processor	VM	Speedup
Pentium	IBM 1.3.0	9.4%
Pentium	Sun 1.2.2	9.0%
SPARC	Sun 1.2.2	7.8%
Pentium	Sun 1.3.1	-2.3%
SPARC	Sun 1.3.1	-3.9%

On the IBM virtual machine and version 1.2.2 of the Sun virtual machine on both processors, inlining fields produced a significant speedup. However, on version 1.3.1 of the Sun virtual machine (again, on both processors), inlining fields caused a slowdown. This indicates that version 1.3.1 of the Sun virtual machine performs some optimization that interacts poorly with object inlining. For example, aggressive loop hoisting of common subexpressions could move a read of an inlinable field out of a loop, drastically reducing the number of reads eliminated by inlining the field.

8   Conclusion

The applicability of object inlining to Java programs is highly dependent on the individual program being optimized, but some programs benefit significantly. It is worthwhile to use both Dolby and Chien's, and Laud's definition when considering fields for inlining.

References

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A   Appendix

Inlinable fields found in boyer:

definition	declaring class	declared type	field name	children	writes	reads
both	java/io/BufferedInputStream	[B	single	1	1	0
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	1	1	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	2	2	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	8	8	0
both	java/util/Vector	[Ljava/lang/Object;	elementData	2	2	0
Laud	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	java/util/Vector$1	Ljava/util/Vector;	this$0	2	2	2
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
Dolby	java/io/File	Ljava/lang/String;	path	10	10	36
both	java/util/Hashtable	Ljava/util/HashMap;	map	2	2	46
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	6	6	385
both	java/io/BufferedOutputStream	[B	buf	3	3	654
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	5	5	872
both	Fe	Ri	a	1	1	1192
both	java/util/StringTokenizer	[C	input	5	5	5815
both	Fb	Rk	a	960	960	9510
both	Rh	Re	a	91	91	31038
both	Rk	LRj;	a	34609	34609	40460
both	Fd	F	b	1	1	79740
both	Fd	F	a	1	1	79740
both	Rc	LRb;	a	106	106	81503
both	Rb	LS;	a	106	106	81503
both	Rb	LS;	b	106	106	81503
both	Fc	F	a	1	1	95024
both	Re	LRd;	b	91	91	256062

Inlinable fields found in check:

definition	declaring class	declared type	field name	children	writes	reads
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	2	2	0
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	java/io/BufferedInputStream	[B	single	1	1	0
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	1	1	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
both	java/util/Vector$1	Ljava/util/Vector;	this$0	6	6	14
Dolby	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	81
Dolby	java/io/File	Ljava/lang/String;	path	32	32	112
Laud	java/util/Vector	[Ljava/lang/Object;	elementData	13	13	196
both	kaffe/util/IntegerHashtable	[I	keys	1	1	472
both	java/io/BufferedOutputStream	[B	buf	2	2	491
both	java/io/ByteArrayOutputStream	[B	buf	166	166	512
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	4	4	1057
both	java/util/StringTokenizer	[C	input	15	15	13293

Inlinable fields found in compress:

definition	declaring class	declared type	field name	children	writes	reads
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	spec/benchmarks/_201_compress/Decompressor$De_Stack	Lspec/benchmarks/_201_compress/Decompressor;	this$0	25	50	0
both	spec/benchmarks/_201_compress/Decompressor$Suffix_Table	Lspec/benchmarks/_201_compress/Decompressor;	this$0	25	50	0
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	1	1	0
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	java/io/BufferedInputStream	[B	single	1	1	0
Dolby	spec/io/File	Ljava/lang/String;	filename	5	5	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	7	7	0
both	spec/benchmarks/_201_compress/Compressor$Hash_Table	Lspec/benchmarks/_201_compress/Compressor;	this$0	25	50	0
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
both	java/util/Vector$1	Ljava/util/Vector;	this$0	6	6	14
Dolby	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	java/util/Vector	[Ljava/lang/Object;	elementData	7	7	22
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
Dolby	spec/io/FileCacheData	[B	data	5	5	25
both	spec/io/FileInputStream	java/lang/String	my_file_url	25	25	65
both	spec/io/FileInputStream	java/io/InputStream	orig_in	25	25	80
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	85
Dolby	java/io/File	Ljava/lang/String;	path	37	37	117
both	java/io/BufferedOutputStream	[B	buf	2	2	306
both	java/io/ByteArrayOutputStream	[B	buf	104	104	328
both	kaffe/util/IntegerHashtable	[I	keys	1	1	488
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	4	4	714
both	java/util/Hashtable	Ljava/util/HashMap;	map	7	7	880
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	21	21	6964
both	java/util/StringTokenizer	[C	input	15	15	13293
both	spec/benchmarks/_201_compress/Comp_Base	[B	buf	50	50	39517810
both	spec/benchmarks/_201_compress/Decompressor	Lspec/benchmarks/_201_compress/Code_Table;	tab_prefix	25	25	46143930
both	spec/benchmarks/_201_compress/Compressor	Lspec/benchmarks/_201_compress/Code_Table;	codetab	25	25	46157240
both	spec/benchmarks/_201_compress/Comp_Base	Lspec/benchmarks/_201_compress/Input_Buffer;	Input	50	50	48285700
both	spec/benchmarks/_201_compress/Decompressor	Lspec/benchmarks/_201_compress/Decompressor$Suffix_Table;	tab_suffix	25	25	56005370
both	spec/benchmarks/_201_compress/Decompressor$Suffix_Table	[B	tab	25	25	56011745
both	spec/benchmarks/_201_compress/Compressor	Lspec/benchmarks/_201_compress/Compressor$Hash_Table;	htab	25	25	56018955
both	spec/benchmarks/_201_compress/Comp_Base	Lspec/benchmarks/_201_compress/Output_Buffer;	Output	50	50	65614405
both	spec/benchmarks/_201_compress/Output_Buffer	[B	OutBuff	50	50	65616280
both	spec/benchmarks/_201_compress/Input_Buffer	[B	InBuff	50	50	65616280
both	spec/benchmarks/_201_compress/Code_Table	[S	tab	50	50	92339420
both	spec/benchmarks/_201_compress/Decompressor$De_Stack	[B	tab	25	25	94105550
both	spec/benchmarks/_201_compress/Decompressor	Lspec/benchmarks/_201_compress/Decompressor$De_Stack;	de_stack	25	25	141158325
both	spec/benchmarks/_201_compress/Compressor$Hash_Table	[I	tab	25	25	151569350

Inlinable fields found in db:

definition	declaring class	declared type	field name	children	writes	reads
both	spec/io/File	Ljava/lang/String;	filename	3	3	0
both	java/io/Reader	[C	single	3	3	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
both	java/io/BufferedInputStream	[B	single	1	1	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
Laud	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	5	5	0
both	java/io/StreamTokenizer	Ljava/io/StreamTokenizer$TableEntry;	ordinary	1	1	1
both	java/io/StreamTokenizer	Ljava/io/Reader;	rawIn	1	1	1
both	java/io/StreamTokenizer	Ljava/io/BufferedReader;	bufferedIn	1	1	1
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	java/io/InputStreamReader	Ljava/io/InputStream;	strm	1	1	3
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
both	java/io/InputStreamReader	[B	inbuf	1	1	15
Dolby	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
Laud	spec/benchmarks/_209_db/Database	Ljava/lang/String;	fieldValue	99	99	114
Dolby	java/io/File	Ljava/lang/String;	path	35	35	115
both	java/io/StreamTokenizer	Ljava/lang/StringBuffer;	buffer	1	1	139
both	java/io/FilterReader	Ljava/io/Reader;	in	1	1	173
both	java/io/BufferedReader	Ljava/io/Reader;	rd	1	1	175
both	java/io/BufferedReader	[C	inbuf	1	1	176
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	176
both	java/io/StreamTokenizer	Ljava/io/PushbackReader;	pushIn	1	1	209
both	java/io/PushbackReader	[C	buf	1	1	228
both	spec/benchmarks/_209_db/Database	Ljava/util/Vector;	fmt	1	1	342
both	kaffe/util/IntegerHashtable	[I	keys	1	1	773
both	java/io/StreamTokenizer	[Ljava/io/StreamTokenizer$TableEntry;	lookup	1	1	814
both	java/io/BufferedOutputStream	[B	buf	2	2	2111
both	java/io/ByteArrayOutputStream	[B	buf	706	706	2132
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	4	4	4723
both	java/util/StringTokenizer	[C	input	15	15	13293
both	spec/benchmarks/_209_db/Database	Ljava/util/Vector;	entries	1	1	16534
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	2	2	18875
both	spec/io/FileCacheData	[B	data	3	3	18877
both	spec/io/FileInputStream	Ljava/io/InputStream;	orig_in	3	3	18885
both	spec/io/FileInputStream	Ljava/lang/String;	my_file_url	3	3	18889
Dolby	java/util/Hashtable	Ljava/util/HashMap;	map	8	8	20314
both	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	22	22	45829
Dolby	spec/benchmarks/_209_db/Entry	java/util/Vector	items	15634	15634	50946011
Laud	java/util/Vector	[Ljava/lang/Object;	elementData	15655	15655	54938853

Inlinable fields found in decode:

definition	declaring class	declared type	field name	children	writes	reads
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	2	2	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	1	1	6
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
both	java/util/Vector$1	Ljava/util/Vector;	this$0	6	6	14
both	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
both	java/util/Vector	[Ljava/lang/Object;	elementData	8	8	57
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	85
Dolby	java/io/File	Ljava/lang/String;	path	32	32	112
both	kaffe/util/IntegerHashtable	[I	keys	1	1	492
Dolby	java/util/Hashtable	Ljava/util/HashMap;	map	5	5	690
both	java/io/BufferedInputStream	[B	buf	1	1	744
both	java/io/BufferedInputStream	[B	single	1	1	1440
both	java/io/BufferedOutputStream	[B	buf	2	2	1800
both	java/io/ByteArrayOutputStream	[B	buf	602	602	1822
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	12	12	1855
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	4	4	3680
both	java/util/StringTokenizer	[C	input	15	15	13293

Inlinable fields found in fft:

definition	declaring class	declared type	field name	children	writes	reads
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	2	2	0
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
both	java/io/InputStreamReader	[B	inbuf	1	1	0
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	java/io/BufferedInputStream	[B	single	1	1	0
both	java/io/BufferedReader	Ljava/io/Reader;	rd	1	1	0
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	1	1	0
both	java/io/BufferedReader	[C	inbuf	1	1	0
both	java/io/InputStreamReader	Ljava/io/InputStream;	strm	1	1	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	java/io/Reader	[C	single	2	2	0
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
both	java/util/Vector	[Ljava/lang/Object;	elementData	6	6	12
both	java/util/Vector$1	Ljava/util/Vector;	this$0	6	6	14
both	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	java/io/BufferedOutputStream	[B	buf	2	2	18
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
both	java/io/ByteArrayOutputStream	[B	buf	8	8	40
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	4	4	42
both	java/util/Hashtable	Ljava/util/HashMap;	map	6	6	100
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	112
Dolby	java/io/File	Ljava/lang/String;	path	32	32	112
both	kaffe/util/IntegerHashtable	[I	keys	1	1	577
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	13	13	678
both	java/util/StringTokenizer	[C	input	15	15	13293

Inlinable fields found in illness:

definition	declaring class	declared type	field name	children	writes	reads
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	2	2	0
both	java/util/Vector	[Ljava/lang/Object;	elementData	2	2	0
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	1	1	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	8	8	0
both	java/io/BufferedInputStream	[B	single	1	1	0
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	java/util/Vector$1	Ljava/util/Vector;	this$0	2	2	2
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
Dolby	java/io/File	Ljava/lang/String;	path	10	10	36
both	java/util/Hashtable	Ljava/util/HashMap;	map	2	2	46
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	6	6	385
both	spread_illness/arrayOarrayOintegerFF	[Lspread_illness/_any;	storage	1	1	686
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	4	4	860
both	java/io/BufferedOutputStream	[B	buf	2	2	1620
both	java/util/StringTokenizer	[C	input	5	5	5815
both	spread_illness/spread_illness	Lspread_illness/_any;	world2	1	1	884061
both	spread_illness/arrayOintegerF	[I	storage	20	20	3735420
both	spread_illness/spread_illness	Lspread_illness/_any;	world1	1	1	5996511

Inlinable fields found in jack:

definition	declaring class	declared type	field name	children	writes	reads
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
Laud	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	3	3	0
Laud	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	spec/benchmarks/_228_jack/RJustName	Lspec/benchmarks/_228_jack/RegularExpression;	regexpr	34	34	0
both	java/io/BufferedInputStream	[B	single	1	1	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	spec/io/File	Ljava/lang/String;	filename	1	1	0
both	spec/benchmarks/_228_jack/TokenEngine	Ljava/util/Vector;	newStates	17	17	0
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
Dolby	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
both	spec/benchmarks/_228_jack/Jack_the_Parser_Generator_Internals	Ljava/lang/String;	cu_name	17	17	85
Dolby	spec/benchmarks/_228_jack/NfaState	Lspec/benchmarks/_228_jack/NfaState;	nextForNegatedList	102	102	102
both	java/io/BufferedOutputStream	[B	buf	2	2	102
Dolby	java/io/File	Ljava/lang/String;	path	33	33	113
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	115
Dolby	spec/benchmarks/_228_jack/OneOrMore	spec/benchmarks/_228_jack/Expansion	expansion	51	51	238
Dolby	spec/benchmarks/_228_jack/JavaCodeProduction	java/util/Vector	code_tokens	68	68	340
Dolby	spec/benchmarks/_228_jack/RChoice	java/util/Vector	choices	51	51	408
Dolby	spec/benchmarks/_228_jack/ZeroOrMore	spec/benchmarks/_228_jack/Expansion	expansion	85	85	408
both	kaffe/util/IntegerHashtable	[I	keys	1	1	578
Dolby	spec/benchmarks/_228_jack/ZeroOrOne	spec/benchmarks/_228_jack/Expansion	expansion	119	119	595
Dolby	spec/benchmarks/_228_jack/RZeroOrMore	spec/benchmarks/_228_jack/RegularExpression	regexpr	119	119	714
both	spec/benchmarks/_228_jack/CharPosInputStream	[C	labuf	17	17	986
Dolby	spec/benchmarks/_228_jack/NormalProduction	java/util/Vector	return_type_tokens	357	357	1428
Dolby	spec/benchmarks/_228_jack/NormalProduction	java/util/Vector	parameter_list_tokens	357	357	1479
Dolby	spec/benchmarks/_228_jack/Production	Lspec/benchmarks/_228_jack/Expansion;	expansion	323	323	2006
Dolby	spec/benchmarks/_228_jack/Token_Entry	Lspec/benchmarks/_228_jack/RegularExpression;	rexp	2091	2091	2091
Dolby	spec/benchmarks/_228_jack/NonTerminal	java/lang/String	name	731	731	2720
Dolby	spec/benchmarks/_228_jack/NonTerminal	java/util/Vector	argument_tokens	731	731	2737
both	spec/benchmarks/_228_jack/LexGen	Ljava/io/PrintStream;	ostr	17	17	2873
both	spec/benchmarks/_228_jack/RegularExpression	Lspec/benchmarks/_228_jack/NfaState;	finalState	4403	4403	2941
both	spec/benchmarks/_228_jack/NfaState	Ljava/util/Hashtable;	rangeMoves	9299	9299	3213
both	spec/benchmarks/_228_jack/RegularExpression	Lspec/benchmarks/_228_jack/NfaState;	startState	4403	4403	3536
both	spec/benchmarks/_228_jack/ParseGen	Ljava/util/Vector;	phase2and3list	17	17	3604
Dolby	spec/benchmarks/_228_jack/Action	java/util/Vector	action_tokens	986	986	3944
Laud	spec/benchmarks/_228_jack/RCharacterList	java/util/Vector	descriptors	748	748	4641
both	spec/benchmarks/_228_jack/NfaState	Ljava/util/Hashtable;	charMoves	9299	9299	5372
Dolby	spec/benchmarks/_228_jack/Choice	java/util/Vector	choices	204	204	6341
Dolby	spec/benchmarks/_228_jack/Sequence	java/util/Vector	units	833	833	7276
both	spec/benchmarks/_228_jack/KindInfo	[J	finalKinds	214	214	9265
both	java/util/StringTokenizer	[C	input	15	15	13293
both	spec/benchmarks/_228_jack/KindInfo	[J	validKinds	214	214	13532
Dolby	spec/benchmarks/_228_jack/RStringLiteral	java/lang/String	image	3502	3502	16150
both	spec/io/FileCacheData	[B	data	1	1	17068
both	spec/io/FileInputStream	Ljava/lang/String;	my_file_url	17	17	17088
both	spec/benchmarks/_228_jack/NfaState	Ljava/util/Vector;	epsilonMoves	9299	9299	30430
both	spec/benchmarks/_228_jack/Jack_the_Parser_Generator	Lspec/benchmarks/_228_jack/TrueException;	etrue	17	17	39338
both	spec/benchmarks/_228_jack/ParseGen	Ljava/io/PrintStream;	ostr	17	17	86785
both	spec/benchmarks/_228_jack/Jack_the_Parser_Generator	Lspec/benchmarks/_228_jack/FalseException;	efalse	17	17	202521
both	spec/benchmarks/_228_jack/CharPosInputStream	Ljava/io/DataInputStream;	inputStream	17	17	289901
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	18	18	289901
both	spec/io/FileInputStream	Ljava/io/InputStream;	orig_in	17	17	289917
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	55	55	296446

Laud	spec/benchmarks/_228_jack/Jack_the_Parser_Generator	Lspec/benchmarks/_228_jack/Token;	token	26129	390167	390541
both	spec/benchmarks/_228_jack/Jack_the_Parser_Generator	Lspec/benchmarks/_228_jack/TokenManager;	token_source	17	17	461397
both	spec/benchmarks/_228_jack/CharPosInputStream	[C	buffer	17	17	571319
both	spec/benchmarks/_228_jack/TokenEngine	[Lspec/benchmarks/_228_jack/Token;	token_buffer	34	34	585786
both	spec/benchmarks/_228_jack/CharPosInputStream	[I	bufcolumn	17	17	787253
both	spec/benchmarks/_228_jack/CharPosInputStream	[I	bufline	17	17	787253
both	java/io/ByteArrayOutputStream	[B	buf	296142	296142	864744
both	spec/benchmarks/_228_jack/TokenEngine	Lspec/benchmarks/_228_jack/CharStream;	input_stream	17	17	1068773
both	spec/benchmarks/_228_jack/RunTimeNfaState	spec/benchmarks/_228_jack/RunTimeNfaState	nextForNegatedList	6	6	1261196
both	spec/benchmarks/_228_jack/RunTimeNfaState	java/util/Hashtable	charMoves	69	69	1340534
both	spec/benchmarks/_228_jack/RunTimeNfaState	java/util/Hashtable	rangeMoves	69	69	1435472
both	spec/benchmarks/_228_jack/RunTimeNfaState	java/util/Vector	epsilonMoves	69	69	2611068
Dolby	java/util/AbstractMap$1	Ljava/util/AbstractMap;	this$0	2417	2417	2644180
Dolby	java/util/AbstractMap	Ljava/util/Set;	keyset	2417	2417	2644180
both	java/util/AbstractMap$2	Ljava/util/Iterator;	i	1322090	1322090	2773414
Dolby	java/util/Hashtable	Ljava/util/HashMap;	map	18807	18807	3121976
Laud	spec/benchmarks/_228_jack/TokenEngine	Ljava/util/Vector;	oldStates	124355	312579	4314362
Laud	java/util/Vector	[Ljava/lang/Object;	elementData	1463285	1463285	11392402
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	19006	19006	36584010

Inlinable fields found in jess:

definition	declaring class	declared type	field name	children	writes	reads
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	1	1	0
both	spec/benchmarks/_202_jess/jess/Rete	Ljava/io/StreamTokenizer;	st	1	1	0
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	spec/benchmarks/_202_jess/jess/Defrule	Lspec/benchmarks/_202_jess/jess/NodeTerm;	activator	8	8	0
both	spec/io/File	Ljava/lang/String;	filename	1	1	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	3	3	0
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	java/io/Reader	[C	single	9	9	0
both	java/io/BufferedInputStream	[B	single	1	1	0
both	spec/benchmarks/_202_jess/jess/Rete	Ljava/util/Vector;	defglobals	1	1	1
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	java/io/StreamTokenizer	Ljava/io/StreamTokenizer$TableEntry;	ordinary	3	3	2
both	java/io/StreamTokenizer	Ljava/io/BufferedReader;	bufferedIn	3	3	3
both	java/io/StreamTokenizer	Ljava/io/Reader;	rawIn	3	3	3
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	spec/benchmarks/_202_jess/jess/Rete	Ljava/util/Vector;	deffacts	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	spec/benchmarks/_202_jess/jess/Deffacts	Ljava/util/Vector;	facts	1	1	7
both	java/util/Observable	Ljava/util/ArrayList;	observers	1	1	8
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
both	java/util/Vector$1	Ljava/util/Vector;	this$0	6	6	14
both	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
Dolby	spec/benchmarks/_202_jess/jess/Deftemplate	Lspec/benchmarks/_202_jess/jess/ValueVector;	deft	10	10	56
both	spec/benchmarks/_202_jess/jess/GlobalContext	Ljava/util/Vector;	global_bindings	1	1	68
both	spec/benchmarks/_202_jess/jess/Rete	Ljava/util/Vector;	rules	1	1	72
both	spec/benchmarks/_202_jess/jess/Context	Ljava/util/Vector;	actions	9	9	74
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	88
both	spec/io/FileCacheData	[B	data	1	1	98
both	spec/io/FileInputStream	Ljava/io/InputStream;	orig_in	1	1	100
both	java/io/InputStreamReader	Ljava/io/InputStream;	strm	3	3	101
both	spec/io/FileInputStream	Ljava/lang/String;	my_file_url	1	1	102
Dolby	java/io/File	Ljava/lang/String;	path	33	33	113
Dolby	spec/benchmarks/_202_jess/jess/Fact	Lspec/benchmarks/_202_jess/jess/ValueVector;	fact	83	83	252
both	spec/benchmarks/_202_jess/jess/Pattern	[I	slotlengths	25	25	266
both	spec/benchmarks/_202_jess/jess/Rete	Ljava/util/Hashtable;	deftemplates	1	1	327
both	kaffe/util/IntegerHashtable	[I	keys	1	1	493
both	spec/benchmarks/_202_jess/jess/Node2	Ljava/util/Vector;	_tests	64	64	498
both	java/io/InputStreamReader	[B	inbuf	3	3	505
both	spec/benchmarks/_202_jess/jess/ReteCompiler	Lspec/benchmarks/_202_jess/jess/Rete;	rete	1	1	559
both	spec/benchmarks/_202_jess/jess/Defrule	Ljava/util/Vector;	patts	8	8	748
both	spec/benchmarks/_202_jess/jess/NodeTerm	Lspec/benchmarks/_202_jess/jess/Defrule;	rule	8	8	1470
both	spec/benchmarks/_202_jess/jess/ReteCompiler	Ljava/util/Vector;	roots	1	1	1824
both	spec/benchmarks/_202_jess/jess/JessTokenStream	Ljava/io/StreamTokenizer;	m_stream	2	2	2174
both	java/io/BufferedOutputStream	[B	buf	2	2	2289
both	java/io/ByteArrayOutputStream	[B	buf	765	765	2311
both	spec/benchmarks/_202_jess/jess/Jesp	Lspec/benchmarks/_202_jess/jess/JessTokenStream;	jts	2	2	2648
both	spec/benchmarks/_202_jess/jess/Context	Ljava/util/Stack;	states	9	9	2684
both	spec/benchmarks/_202_jess/jess/JessTokenStream	Ljava/lang/StringBuffer;	m_string	2	2	2859
both	spec/benchmarks/_202_jess/jess/Defrule	[Lspec/benchmarks/_202_jess/jess/ValueVector;	_actions	8	8	2918
both	spec/benchmarks/_202_jess/jess/Rete	Lspec/benchmarks/_202_jess/jess/ReteCompiler;	rc	1	1	3238
both	spec/benchmarks/_202_jess/jess/Node	java/util/Vector	succ	166	166	3985
both	spec/benchmarks/_202_jess/jess/Rete	Lspec/benchmarks/_202_jess/jess/ReteDisplay;	display	1	1	4714
both	spec/benchmarks/_202_jess/jess/NodeTerm	Ljava/util/Vector;	activations	8	8	4946
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	4	4	4956
Dolby	spec/benchmarks/_202_jess/jess/ContextState	java/util/Vector	bindings	1342	1342	5562

both	spec/benchmarks/_202_jess/jess/JessTokenStream	Ljava/util/Stack;	m_stack	2	2	7255
both	java/io/StreamTokenizer	Ljava/lang/StringBuffer;	buffer	3	3	7747
both	java/io/FilterReader	Ljava/io/Reader;	in	3	3	12584
both	java/io/BufferedReader	Ljava/io/Reader;	rd	3	3	12589
both	java/io/BufferedReader	[C	inbuf	3	3	12592
both	java/util/StringTokenizer	[C	input	15	15	13293
Laud	spec/benchmarks/_202_jess/jess/Pattern	[[Lspec/benchmarks/_202_jess/jess/Test1;	tests	119	119	15398
both	java/io/StreamTokenizer	Ljava/io/PushbackReader;	pushIn	3	3	17382
both	java/io/PushbackReader	[C	buf	3	3	19784
both	java/io/StreamTokenizer	[Ljava/io/StreamTokenizer$TableEntry;	lookup	3	3	25633
both	spec/benchmarks/_202_jess/jess/Rete	Lspec/benchmarks/_202_jess/jess/GlobalContext;	global_context	1	1	67227
Dolby	spec/benchmarks/_202_jess/jess/Test1	spec/benchmarks/_202_jess/jess/Value	slot_value	316	316	72788
both	spec/benchmarks/_202_jess/jess/Node2	Lspec/benchmarks/_202_jess/jess/TokenVector;	left	64	64	84929
Laud	spec/benchmarks/_202_jess/jess/Node	[Lspec/benchmarks/_202_jess/jess/Successor;	_succ	903	903	114037
both	spec/benchmarks/_202_jess/jess/Rete	Ljava/util/Vector;	activations	1	1	148250
both	spec/benchmarks/_202_jess/jess/Rete	Ljava/util/Hashtable;	deffunctions	1	1	701290
both	spec/benchmarks/_202_jess/jess/Rete	Ljava/util/Hashtable;	userfunctions	1	1	701342
both	spec/benchmarks/_202_jess/jess/Rete	Ljava/util/Vector;	facts	1	1	1097700
Laud	java/util/Vector	[Ljava/lang/Object;	elementData	1742	1742	1441453
both	spec/benchmarks/_202_jess/jess/Node2	Lspec/benchmarks/_202_jess/jess/TokenVector;	right	64	64	1910158
Dolby	spec/benchmarks/_202_jess/jess/Value	Ljava/lang/Object;	Objectval	637062	637062	1977212
Dolby	java/util/Hashtable	Ljava/util/HashMap;	map	13	13	3516682
Laud	spec/benchmarks/_202_jess/jess/TokenVector	[Lspec/benchmarks/_202_jess/jess/Token;	v	783	783	5910432
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	30	30	7040357
both	spec/benchmarks/_202_jess/jess/Node2	[Ljava/lang/Object;	tests	63	63	8158245
both	spec/benchmarks/_202_jess/jess/Token	[Lspec/benchmarks/_202_jess/jess/ValueVector;	facts	1893403	1893403	27566157
Laud	spec/benchmarks/_202_jess/jess/ValueVector	[Lspec/benchmarks/_202_jess/jess/Value;	v	707842	707842	43477274

Inlinable fields found in lexgen:

definition	declaring class	declared type	field name	children	writes	reads
both	java/util/Vector	[Ljava/lang/Object;	elementData	2	2	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	Ei	Ljava/lang/String;	b	167	167	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	8	8	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	3	3	0
both	Ei	LRc;	a	167	167	0
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	5	5	0
both	java/io/BufferedInputStream	[B	single	3	3	0
both	Fc	F	a	167	167	0
both	java/util/Vector$1	Ljava/util/Vector;	this$0	2	2	2
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	3	3	7
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
Dolby	R0	LS;	b	9	9	19
both	R3	LR2;	a	10	10	28
both	java/io/BufferedInputStream	[B	buf	3	3	36
both	java/io/File	Ljava/lang/String;	path	10	10	36
both	java/util/Hashtable	Ljava/util/HashMap;	map	2	2	47
both	Sg	Rk	a	95	95	95
both	Rs	LRc;	a	95	95	95
Laud	R5	Ru	a	96	96	96
Dolby	R0	Ljava/lang/String;	a	9	9	104
Dolby	Sf	java/lang/String	a	128	128	128
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	7	7	141
both	Rs	LS;	b	95	95	190
both	Rt	LRs;	a	95	95	190
Dolby	Se	[I	a	299	299	299
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	6	6	387
Laud	R6	Rl	a	762	762	762
Laud	Ry	LS;	a	773	773	1075
both	java/util/StringTokenizer	[C	input	5	5	5815
both	Rw	LRr;	b	2	2	8087
both	Rw	Ljava/io/BufferedInputStream;	a	2	2	8088
both	Rx	LRw;	a	2	2	8088
both	Rr	LRo;	b	2	2	8095
both	Rr	LRp;	a	2	2	8095
Laud	R4	LRm;	a	250	250	13007
both	Rq	Ljava/io/BufferedOutputStream;	a	2	2	46754
both	java/io/BufferedOutputStream	[B	buf	5	5	93531

Inlinable fields found in lu:

definition	declaring class	declared type	field name	children	writes	reads
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	java/io/BufferedReader	[C	inbuf	1	1	0
both	java/io/Reader	[C	single	2	2	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	2	2	0
both	java/io/InputStreamReader	[B	inbuf	1	1	0
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	java/io/BufferedInputStream	[B	single	1	1	0
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	1	1	0
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
both	java/io/InputStreamReader	Ljava/io/InputStream;	strm	1	1	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	java/io/BufferedReader	Ljava/io/Reader;	rd	1	1	0
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
both	java/util/Vector	[Ljava/lang/Object;	elementData	6	6	12
both	java/util/Vector$1	Ljava/util/Vector;	this$0	6	6	14
Dolby	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
both	java/io/BufferedOutputStream	[B	buf	2	2	30
both	java/io/ByteArrayOutputStream	[B	buf	12	12	52
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	4	4	70
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	102
both	java/util/Hashtable	Ljava/util/HashMap;	map	6	6	104
Dolby	java/io/File	Ljava/lang/String;	path	32	32	112
both	kaffe/util/IntegerHashtable	[I	keys	1	1	559
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	13	13	686
both	java/util/StringTokenizer	[C	input	15	15	13293

Inlinable fields found in machineSim:

definition	declaring class	declared type	field name	children	writes	reads
both	java/io/BufferedInputStream	[B	single	1	1	0
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
Laud	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	5	5	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	1	1	0
both	java/io/Reader	[C	single	6	6	0
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
both	java/util/Vector	[Ljava/lang/Object;	elementData	6	6	12
both	java/util/Vector$1	Ljava/util/Vector;	this$0	6	6	14
Dolby	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	Shifter	LBus;	bus	1	1	20
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
both	Shifter	LSR;	sr	1	1	42
both	java/io/InputStreamReader	Ljava/io/InputStream;	strm	3	3	47
both	IR	LBus;	bus	1	1	56
both	Registers	LIR;	ir	1	1	62
both	ALU	LIR;	ir	1	1	69
both	CS	LBus;	bus	1	1	71
Dolby	java/io/File	Ljava/lang/String;	path	32	32	112
both	java/io/BufferedReader	Ljava/io/Reader;	rd	3	3	153
both	java/util/Hashtable	Ljava/util/HashMap;	map	6	6	202
both	MainMemory	LBus;	bus	1	1	216
both	java/io/BufferedOutputStream	[B	buf	2	2	216
both	java/io/InputStreamReader	[B	inbuf	3	3	235
both	ALU	LSR;	sr	1	1	288
both	ALU	LBus;	bus	1	1	294
both	Registers	LBus;	bus	1	1	329
both	java/io/ByteArrayOutputStream	[B	buf	108	108	340
both	Registers	[J	regArray	1	1	427
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	4	4	742
both	CS	[LCSWord;	CS	1	1	835
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	13	13	882
both	Shifter	LIR;	ir	1	1	1020
both	MainMemory	[I	displays	1	1	1648
both	CS	LShifter;	shifter	1	1	1676
both	CS	LSR;	sr	1	1	1703
both	CSWord	[J	ops	128	128	1749
both	CS	LIR;	ir	1	1	2894
both	CS	LALU;	alu	1	1	5028
both	java/io/BufferedReader	[C	inbuf	3	3	5388
both	CS	LMainMemory;	mem	1	1	6874
both	CS	LRegisters;	regs	1	1	9218
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	9961
both	java/util/StringTokenizer	[C	input	30	30	17734
both	kaffe/util/IntegerHashtable	[I	keys	1	1	30160
both	MainMemory	[I	memory	1	1	263241

Inlinable fields found in matrix:

definition	declaring class	declared type	field name	children	writes	reads
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	2	2	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	1	1	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	java/io/BufferedInputStream	[B	single	1	1	0
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
both	java/util/Vector	[Ljava/lang/Object;	elementData	6	6	12
both	java/util/Vector$1	Ljava/util/Vector;	this$0	6	6	14
Dolby	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	81
Dolby	java/io/File	Ljava/lang/String;	path	32	32	112
both	kaffe/util/IntegerHashtable	[I	keys	1	1	472
Dolby	java/util/Hashtable	Ljava/util/HashMap;	map	5	5	492
both	java/io/BufferedOutputStream	[B	buf	2	2	1206
both	java/io/ByteArrayOutputStream	[B	buf	404	404	1228
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	12	12	1459
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	4	4	2814
both	java/util/StringTokenizer	[C	input	15	15	13293
both	Matrix	[D	data	4	4	52655856

Inlinable fields found in probe:

definition	declaring class	declared type	field name	children	writes	reads
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	1	1	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	2	2	0
both	java/io/RandomAccessFile	Ljava/io/FileDescriptor;	fd	886	886	0
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	java/io/BufferedInputStream	[B	single	1	1	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	5
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	10
both	java/util/Vector	[Ljava/lang/Object;	elementData	6	6	12
both	java/util/Vector$1	Ljava/util/Vector;	this$0	6	6	14
Dolby	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
Dolby	java/io/File	Ljava/lang/String;	path	32	32	112
Dolby	java/util/Hashtable	Ljava/util/HashMap;	map	5	5	990
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	12	12	2462
both	java/io/BufferedOutputStream	[B	buf	2	2	2697
both	java/io/ByteArrayOutputStream	[B	buf	901	901	2719
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	4	4	5408
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	12471
both	java/util/StringTokenizer	[C	input	16	16	14144
both	kaffe/util/IntegerHashtable	[I	keys	1	1	37682

Inlinable fields found in puzzle:

definition	declaring class	declared type	field name	children	writes	reads
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	1	1	0
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	6	6	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	java/io/BufferedInputStream	[B	single	1	1	0
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	20	20	0
both	java/io/Reader	[C	single	8	8	0
both	java/io/BufferedInputStream	[B	buf	1	1	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
both	java/util/Vector	[Ljava/lang/Object;	elementData	6	6	12
both	java/util/Vector$1	Ljava/util/Vector;	this$0	6	6	14
both	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
both	java/io/BufferedReader	Ljava/io/Reader;	rd	4	4	28
both	java/io/BufferedReader	[C	inbuf	4	4	94
Dolby	java/io/File	Ljava/lang/String;	path	32	32	112
both	java/io/BufferedOutputStream	[B	buf	2	2	137
both	java/util/Hashtable	Ljava/util/HashMap;	map	6	6	143
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	156
both	java/io/ByteArrayOutputStream	[B	buf	48	48	158
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	20	20	385
both	java/io/InputStreamReader	Ljava/io/InputStream;	strm	4	4	442
both	kaffe/util/IntegerHashtable	[I	keys	1	1	729
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	13	13	764
both	java/io/InputStreamReader	[B	inbuf	4	4	2190
both	java/util/StringTokenizer	[C	input	15	15	13293

Inlinable fields found in raytrace:

definition	declaring class	declared type	field name	children	writes	reads
both	java/lang/Thread	[C	name	1	1	0
both	java/io/FileOutputStream	Ljava/io/FileDescriptor;	fd	4	4	0
both	java/lang/Thread	Ljava/lang/Throwable;	stackOverflowError	1	1	0
both	java/io/BufferedInputStream	[B	single	2	2	0
both	java/net/URLConnection	Ljava/net/URL;	url	2	2	0
both	java/io/FileInputStream	Ljava/io/FileDescriptor;	fd	3	3	0
both	java/lang/Thread	Ljava/lang/Throwable;	outOfMemoryError	1	1	0
Dolby	java/util/zip/ZipFile	Ljava/lang/String;	name	26	26	0
both	spec/io/File	Ljava/lang/String;	filename	1	1	0
both	java/lang/ClassLoader	Ljava/util/Hashtable;	loadedClasses	1	1	0
both	spec/benchmarks/_205_raytrace/MaterialNode	Lspec/benchmarks/_205_raytrace/Material;	theMaterial	8	8	0
both	spec/benchmarks/_205_raytrace/Camera	Lspec/benchmarks/_205_raytrace/Vector;	orthoUp	1	1	1
both	spec/benchmarks/_205_raytrace/Camera	Lspec/benchmarks/_205_raytrace/Vector;	viewDirection	1	1	1
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/io/File;	underlyingFile	2	2	2
both	spec/benchmarks/_205_raytrace/RayTracer	Lspec/benchmarks/_205_raytrace/Canvas;	canvas	1	1	2
both	java/lang/ClassLoader	Ljava/util/Set;	loadedLibraries	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/util/jar/JarFile;	jarFile	2	2	4
both	kaffe/net/DefaultURLStreamHandlerFactory	Ljava/util/Hashtable;	cache	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/lang/String;	jarEntryName	2	2	4
both	spec/benchmarks/_205_raytrace/Camera	Lspec/benchmarks/_205_raytrace/Point;	position	1	1	4
both	kaffe/net/www/protocol/jar/JarURLConnection	Ljava/net/URL;	jarFileURL	2	2	4
both	spec/benchmarks/_205_raytrace/Runner	Lspec/benchmarks/_205_raytrace/RayTracer;	parent	1	1	4
both	java/net/URL	Ljava/net/URLConnection;	conn	2	2	4
both	java/util/HashSet	Ljava/util/HashMap;	map	1	1	8
both	java/util/Vector$1	Ljava/util/Vector;	this$0	6	6	14
both	java/util/Vector	[Ljava/lang/Object;	elementData	7	7	14
both	java/net/URL	Ljava/lang/String;	protocol	8	16	18
both	java/util/Locale	Ljava/lang/String;	var	22	22	22
both	java/util/Locale	Ljava/lang/String;	lang	22	22	22
Dolby	java/io/File	Ljava/lang/String;	path	33	33	113
both	spec/io/FileCacheData	[B	data	1	1	170
both	spec/io/FileInputStream	Ljava/io/InputStream;	orig_in	1	1	173
both	spec/io/FileInputStream	Ljava/lang/String;	my_file_url	1	1	174
both	java/io/BufferedOutputStream	[B	buf	2	2	762
both	java/io/ByteArrayOutputStream	[B	buf	256	256	784
both	java/util/Hashtable	Ljava/util/HashMap;	map	7	7	1149
both	java/io/FilterOutputStream	Ljava/io/OutputStream;	out	4	4	1778
both	kaffe/util/IntegerHashtable	[Ljava/lang/Object;	elements	1	1	2919
Laud	java/util/HashMap	[Ljava/util/HashMap$Entry;	table	21	21	7490
both	kaffe/util/IntegerHashtable	[I	keys	1	1	9018
both	spec/benchmarks/_205_raytrace/SphereObj	Lspec/benchmarks/_205_raytrace/Point;	Origin	5	5	11584
both	java/util/StringTokenizer	[C	input	15	15	13293
both	spec/benchmarks/_205_raytrace/Material	Lspec/benchmarks/_205_raytrace/Color;	specColor	8	8	22417
both	spec/benchmarks/_205_raytrace/Material	Lspec/benchmarks/_205_raytrace/Color;	ambColor	8	8	25473
both	spec/benchmarks/_205_raytrace/Material	Lspec/benchmarks/_205_raytrace/Color;	emissColor	8	8	25473
both	spec/benchmarks/_205_raytrace/TriangleObj	Lspec/benchmarks/_205_raytrace/Vector;	S3	1395	1395	39684
both	spec/benchmarks/_205_raytrace/Scene	Lspec/benchmarks/_205_raytrace/OctNode;	octree	1	1	40000
both	spec/benchmarks/_205_raytrace/Light	Lspec/benchmarks/_205_raytrace/Color;	lightColor	2	2	46375
both	spec/benchmarks/_205_raytrace/Material	Lspec/benchmarks/_205_raytrace/Color;	diffColor	8	8	46375
both	spec/benchmarks/_205_raytrace/Light	Lspec/benchmarks/_205_raytrace/Point;	lightPosition	2	2	50946
both	spec/benchmarks/_205_raytrace/PolyTypeObj	[Lspec/benchmarks/_205_raytrace/Point;	Vertices	1407	1407	95651
both	spec/benchmarks/_205_raytrace/LightNode	Lspec/benchmarks/_205_raytrace/Light;	theLight	2	2	97321
both	spec/benchmarks/_205_raytrace/TriangleObj	Lspec/benchmarks/_205_raytrace/Vector;	S2	1395	1395	171820
both	spec/benchmarks/_205_raytrace/ObjectType	Lspec/benchmarks/_205_raytrace/Point;	Max	1412	1412	224208
both	spec/benchmarks/_205_raytrace/Canvas	[I	Pixels	1	1	240325
both	spec/benchmarks/_205_raytrace/ObjectType	Lspec/benchmarks/_205_raytrace/Point;	Min	1412	1412	271937
both	java/io/FilterInputStream	Ljava/io/InputStream;	in	3	3	360367
both	java/io/BufferedInputStream	[B	buf	2	4	360883
both	spec/benchmarks/_205_raytrace/TriangleObj	Lspec/benchmarks/_205_raytrace/Vector;	S1	1395	1395	1156903
both	spec/benchmarks/_205_raytrace/ObjectType	Lspec/benchmarks/_205_raytrace/CacheIntersectPt;	IntersectCache	1412	1412	1695269
both	spec/benchmarks/_205_raytrace/OctNode	[Lspec/benchmarks/_205_raytrace/OctNode;	Adjacent	65410	65410	1774869
both	spec/benchmarks/_205_raytrace/PolyTypeObj	Lspec/benchmarks/_205_raytrace/Vector;	Normal	1407	1407	3257216
Dolby	spec/benchmarks/_205_raytrace/IntersectPt	Lspec/benchmarks/_205_raytrace/Point;	Intersection	177192	177192	5187620
both	spec/benchmarks/_205_raytrace/OctNode	[Lspec/benchmarks/_205_raytrace/OctNode;	Child	65410	65410	6400028

both	spec/benchmarks/_205_raytrace/Ray	Lspec/benchmarks/_205_raytrace/Vector;	Direction	150308	150308	17147259
both	spec/benchmarks/_205_raytrace/Face	[Lspec/benchmarks/_205_raytrace/Point;	Verts	17958	17958	31803843
both	spec/benchmarks/_205_raytrace/OctNode	[Lspec/benchmarks/_205_raytrace/Face;	OctFaces	65410	65410	32156433