main.c

```
/* Main */
#include <stdio.h>
#include <stdlib.h>
#include <stdbool.h>

#include "config.h"
#include "cache.h"

void process_trace(struct cache *l1i,
                struct cache *l1d,
                struct cache *l2,
                struct mem_config *mem)
{
       char op;
       unsigned long long address;
       int bytesize;
       unsigned long long insts = 0;
       unsigned long long cost;
       while (scanf("%c %llx %d\n", &op, &address, &bytesize) == 3) {
              switch (op) {
              case 'I':
                     insts++;
                     cost = dispatch_read(l1i, address, bytesize);
                     stats.inst_cycles += cost;
                     stats.insts++;
                     if ((insts % 380000) == 0) {
                            unsigned long long l1d_flush = cache_flush(l1d);
                            unsigned long long l2_flush = cache_flush(l2);
                            cache_flush(l1i);
                            stats.inst_cycles += l1d_flush + l2_flush;
                            stats.flush_time += l1d_flush + l2_flush;
                            stats.flushes++;
                     }
                     break;
              case 'W':
                     cost = dispatch_write(l1d, address, bytesize);
                     stats.write_cycles += cost;
                     stats.writes++;
                     break;
              case 'R':
                     stats.read_cycles += dispatch_read(l1d , address, bytesize);
                     stats.reads++;
                     break;
              }
       }
}

void output_stats(struct stat_struct *result, struct mem_config *mem, struct cache
*l1_i, struct cache *l1_d, struct cache *l2)
{
       printf("\n");
       printf("Memory System:\n");
       printf("    Dcache Size = %d : ways = %d : block size = %d\n", l1_d->cache_size
* l1_d->block_size * l1_d->assoc, l1_d->assoc,l1_d->block_size);
```

```
      printf("    Icache Size = %d : ways = %d : block size = %d\n", l1_i->cache_size
* l1_i->block_size * l1_i->assoc, l1_i->assoc,l1_i->block_size);
      printf("    L2-cache Size = %d : ways = %d : block size = %d\n", l2->cache_size
* l2->block_size * l2->assoc, l2->assoc,l2->block_size);
      printf("    Memory ready time = %d : chunksize = %d : chunktime = %d\n",
mem->mem_ready, mem->mem_chunksize, mem->mem_chunktime);
      printf("\n");

      printf("Execute Time = %lld; Total References = %lld\n", result->read_cycles +
result->write_cycles + result->inst_cycles, result->reads + result->writes +
result->insts);
      printf("Flush Time = %lld\n", result->flush_time);
      printf("Inst refs = %lld; Data refs = %lld\n",result->insts,result->reads +
result->writes);
      printf("\n");

      printf("Number of references types: [Percentage]\n");
      printf("    Reads  =     %lld    [%.1f%%]\n", result->reads
,100*((double)result->reads)/(result->reads+result->writes+result->insts));
      printf("    Writes =     %lld    [%.1f%%]\n",
result->writes,100*((double)result->writes)/(result->reads+result->writes+result->insts
));
      printf("    Inst.  =     %lld    [%.1f%%]\n",
result->insts,100*((double)result->insts)/(result->reads+result->writes+result->insts))
;
      printf("    Total  =     %lld\n",result->reads+result->writes+result->insts);
      printf("\n");

      unsigned long long extime = result->read_cycles + result->write_cycles +
result->inst_cycles;
      printf("Total cycles for activities: [Percentage]\n");
      printf("    Reads  =     %lld
[%.1f%%]\n",result->read_cycles,100*((double)(result->read_cycles))/extime);
      printf("    Writes =     %lld
[%.1f%%]\n",result->write_cycles,100*((double)(result->write_cycles))/extime);
      printf("    Inst.  =     %lld
[%.1f%%]\n",result->inst_cycles,100*((double)(result->inst_cycles))/extime);
      printf("    Total  =     %lld\n",extime);
      printf("\n");

      printf("Average cycles for activities:\n");
      printf("  Read =  %.1f; Write =  %.1f; Inst. =
%.1f\n",((double)result->read_cycles)/(result->reads),((double)result->write_cycles)/(r
esult->writes),((double)extime)/(result->insts));
      printf("Ideal: Exec. Time = %lld; CPI =  %.1f\n",result->reads + result->writes
+
2*result->insts,((double)result->reads+result->writes+2*result->insts)/(result->insts))
;
      unsigned long long misaligned_exec = result->insts + l1_i->cache_stats.requests
+ l1_d->cache_stats.requests;
      printf("Ideal mis-aligned: Exec. Time = %lld; CPI = %.1f\n", misaligned_exec,
((double)misaligned_exec / result->insts));
      printf("\n");

      printf("Memory Level: L1i\n");
      printf("    Hit Count = %lld  Miss Count = %lld\n",l1_i->cache_stats.hits,
l1_i->cache_stats.requests - l1_i->cache_stats.hits);
```

```
	printf("    Total Requests = %lld\n",l1_i->cache_stats.requests);
	printf("    Hit Rate = %.1f%%   Miss Rate =
%.1f%%\n",100*((float)(l1_i->cache_stats.hits)/(l1_i->cache_stats.requests)),100*((floa
t)(l1_i->cache_stats.requests - l1_i->cache_stats.hits)/(l1_i->cache_stats.requests)));
	printf("    Kickouts = %lld; Dirty Kickouts = %lld; Transfers =
%lld\n",l1_i->cache_stats.kickouts,l1_i->cache_stats.dirty_kickouts,l1_i->cache_stats.f
lush_kickouts + l1_i->cache_stats.requests - l1_i->cache_stats.hits);
	printf("    Flush Kickouts  =  %lld\n", l1_i->cache_stats.flush_kickouts);
	printf("\n");

	printf("Memory Level: L1d\n");
	printf("    Hit Count = %lld  Miss Count =
%lld\n",l1_d->cache_stats.hits,l1_d->cache_stats.requests - l1_d->cache_stats.hits);
	printf("    Total Requests = %lld\n",l1_d->cache_stats.requests);
	printf("    Hit Rate = %.1f%%   Miss Rate =
%.1f%%\n",100*((float)(l1_d->cache_stats.hits)/(l1_d->cache_stats.requests)),100*((floa
t)(l1_d->cache_stats.requests - l1_d->cache_stats.hits)/(l1_d->cache_stats.requests)));
	printf("    Kickouts = %lld; Dirty Kickouts = %lld; Transfers =
%lld\n",l1_d->cache_stats.kickouts,l1_d->cache_stats.dirty_kickouts,l1_d->cache_stats.f
lush_kickouts + l1_d->cache_stats.requests - l1_d->cache_stats.hits );
	printf("    Flush Kickouts  =  %lld\n", l1_d->cache_stats.flush_kickouts);
	printf("\n");

	printf("Memory Level: L2\n");
	printf("    Hit Count = %lld  Miss Count =
%lld\n",l2->cache_stats.hits,l2->cache_stats.requests - l2->cache_stats.hits);
	printf("    Total Requests = %lld\n",l2->cache_stats.requests);
	printf("    Hit Rate = %.1f%%   Miss Rate =
%.1f%%\n",100*((float)(l2->cache_stats.hits)/(l2->cache_stats.requests)),100*((float)(l
2->cache_stats.requests - l2->cache_stats.hits)/(l2->cache_stats.requests)));
	printf("    Kickouts = %lld; Dirty Kickouts = %lld; Transfers =
%lld\n",l2->cache_stats.kickouts,l2->cache_stats.dirty_kickouts,l2->cache_stats.flush_k
ickouts + l2->cache_stats.requests - l2->cache_stats.hits);
	printf("    Flush Kickouts  =  %lld\n", l2->cache_stats.flush_kickouts);
	printf("\n");

	int l1_i_cost = ((l1_i->cache_size * l1_i->block_size * l1_i->assoc) / 4096) *
(100 + 100 * log_2(l1_i->assoc));
	int l1_d_cost = ((l1_d->cache_size * l1_d->block_size * l1_d->assoc) / 4096) *
(100 + 100 * log_2(l1_d->assoc));
	int l2_cost = ((l2->cache_size * l2->block_size * l2->assoc) / 32768) * (50 + 50
* log_2(l2->assoc));
	int memcost = log_2(mem->mem_ready / 30) * 200 + log_2(mem->mem_chunksize / 8) *
100 + 75;
	printf("L1 cache cost (Icache $%d) + (Dcache $%d) = $%d\n", l1_i_cost,
l1_d_cost, l1_i_cost+l1_d_cost);
	printf("L2 cache cost = $%d;   Memory Cost = $%d   Total Cost = $%d\n", l2_cost,
memcost, memcost + l2_cost + l1_i_cost + l1_d_cost);
	printf("Flushes = %lld : Invalidates = %lld\n", result->flushes,
result->flushes);
	printf("\n");
}

int main(int argc, char **argv)
{
	int transfer_time = 5;
	int bus_width = 16;
```

```
	/* Load configuration from argv[1] if it exists */
	if (argc > 1) {
		load_config(argv[1], &l1_i, &l1_d, &l2, &mem, &transfer_time,
&bus_width);
	}

	l1_i.transfer_time = transfer_time;
	l1_i.bus_width = bus_width;
	l1_d.transfer_time = transfer_time;
	l1_d.bus_width = bus_width;

	init_cache(&l1_i);
	init_cache(&l1_d);
	init_cache(&l2);

	l1_i.backend = &l2;
	l1_d.backend = &l2;
	l2.backend = NULL;

	process_trace(&l1_i, &l1_d, &l2, &mem);

	output_stats(&stats, &mem, &l1_i, &l1_d, &l2);

	return 0;
}
```

cache.c

```
/* Cache implementation */
#include "cache.h"
#include "config.h"
#include <stdlib.h>
#include <stdio.h>

static inline int buf_index(struct cache *cache, int row, int column)
{
	return row * cache->assoc + column;
}

static void print_lru(struct lru *lru)
{
	while (lru) {
		printf("%d", lru->elem);
		if (lru->next) printf(" -> ");
		lru = lru->next;
	}
	printf("\n");
}

struct cache l1_i = {
	.block_size = 32,
	.cache_size = 8196,
	.assoc = 1,
	.hit_time = 1,
	.miss_time = 1,
	.buf = NULL,
	.req_size = 4,
	.name = "l1_i"
};

struct cache l1_d = {
	.block_size = 32,
	.cache_size = 8196,
	.assoc = 1,
	.hit_time = 1,
	.miss_time = 1,
	.buf = NULL,
	.req_size = 4,
	.name = "l1_d"
};

struct cache l2 = {
	.block_size = 64,
	.cache_size = 32768,
	.assoc = 1,
	.hit_time = 5,
	.miss_time = 7,
	.buf = NULL,
	.req_size = 64,
	.name = "l2"
};
```

```
struct stat_struct stats;

static void update_lru(struct cache *cache, int index, int way)
{
	struct lru *cur = cache->lrus[index];

	if (cache->assoc <= 1) return;

	if (cur->elem == way) return;

	while (cur->next && cur->next->elem != way) {
		cur = cur->next;
	}

	struct lru *prev = cache->lrus[index];
	cache->lrus[index] = cur->next;
	cur->next = cur->next->next;
	cache->lrus[index]->next = prev;
}

static void decompose_addr(struct cache* cache,
			unsigned long long addr,
			unsigned long long *tag,
			unsigned long long *index,
			unsigned long long *bi)
{
	*bi = addr & (cache->block_size - 1);
	*index = (addr >> cache->block_bits) & (cache->cache_size - 1);
	*tag = (addr >> cache->block_index_bits);
}

static unsigned long long compose_addr(struct cache* cache,
				unsigned long long tag,
				unsigned long long index,
				unsigned long long bi)
{
	return (tag << cache->block_index_bits) | (index << cache->block_bits);
}

void init_cache(struct cache *cache)
{
	cache->cache_size /= cache->block_size;
	cache->cache_size /= cache->assoc;
	cache->block_bits = log_2(cache->block_size);
	cache->block_index_bits = log_2(cache->block_size * cache->cache_size);
	cache->buf = malloc(cache->cache_size * cache->assoc * sizeof(struct block));
	cache->lrus = malloc(cache->cache_size * sizeof(struct lru*));

	for (int i = 0; i < cache->cache_size; i++) {
		cache->lrus[i] = malloc(sizeof(struct lru));
		struct lru *cur = cache->lrus[i];
		cur->elem = 0;
		for (int j = 1; j < cache->assoc; j++) {
			cur->next = malloc(sizeof(struct lru));
			cur = cur->next;
			cur->elem = j;
		}
```

```
                cur->next = NULL;
                for (int j = 0; j < cache->assoc; j++) {
                        struct block *b = &cache->buf[buf_index(cache, i, j)];
                        b->tag = 0;
                        b->valid = 0;
                        b->dirty = 0;
                }
        }
}


int dispatch_write(struct cache *cache, unsigned long long addr, int bytes)
{
        unsigned long long block_index, index, tag;
        int cost = 0;
        unsigned long long aligned = addr & ~(cache->req_size - 1);
        decompose_addr(cache, addr, &tag, &index, &block_index);

        bytes -= cache->req_size - (addr - aligned);
        cost += cache_write(cache, aligned);

        while (bytes > 0) {
                aligned += cache->req_size;
                decompose_addr(cache, aligned, &tag, &index, &block_index);
                cost += cache_write(cache, aligned);
                bytes -= cache->req_size;
        }
        return cost;
}

int dispatch_read(struct cache *cache, unsigned long long addr, int bytes)
{
        unsigned long long block_index, index, tag;
        int cost = 0;
        unsigned long long aligned = addr & ~(cache->req_size-1);
        decompose_addr(cache, addr, &tag, &index, &block_index);

        bytes -= cache->req_size - (addr - aligned);
        cost += cache_read(cache, aligned);

        while (bytes > 0) {
                aligned += cache->req_size;
                decompose_addr(cache, aligned, &tag, &index, &block_index);
                cost += cache_read(cache, aligned);
                bytes -= cache->req_size;
        }
        return cost;
}

int cache_write(struct cache *cache, unsigned long long addr)
{
        unsigned long long index, tag, bi;
        decompose_addr(cache, addr, &tag, &index, &bi);

        int row = index * cache->assoc;

        cache->cache_stats.requests++;
```

```
	cache->cache_stats.writes++;

	for (int i = 0; i < cache->assoc; i++) {
		int idx = buf_index(cache, index, i);
		if (cache->buf[idx].valid && cache->buf[idx].tag == tag) {
			/* Hit */
			cache->cache_stats.hits++;
			cache->buf[idx].dirty = 1;
			update_lru(cache, index, i);
			return cache->hit_time;
		}
	}

	struct lru *lru = cache->lrus[index];

	while (lru->next) {
		lru = lru->next;
	}
	row = index * cache->assoc + lru->elem;
	update_lru(cache, index, lru->elem);

	/* Miss */
	int cumulative_miss_time = cache->miss_time + cache->hit_time;
	if (cache->buf[row].valid) {
		cache->cache_stats.kickouts++;
		if (cache->buf[row].dirty) {
			cache->cache_stats.dirty_kickouts++;
		}
	}

	if (cache->buf[row].dirty && cache->buf[row].valid) {
		if (cache->backend) {
			unsigned long long writeaddr = compose_addr(cache,
								cache->buf[row].tag,
								index,
								bi);
			cumulative_miss_time += cache_write(cache->backend, writeaddr);
			cumulative_miss_time += cache->transfer_time * (cache->block_size /
cache->bus_width);
		} else {
			/* Go to memory */
			cumulative_miss_time += mem.mem_sendaddr + mem.mem_ready +
				(mem.mem_chunktime * cache->block_size / mem.mem_chunksize);
		}
	}

	if (cache->backend) {
		cumulative_miss_time+=cache_read(cache->backend, addr);
		cumulative_miss_time += cache->transfer_time * (cache->block_size /
cache->bus_width);
	} else {
		/* Go to memory */
		cumulative_miss_time += mem.mem_sendaddr + mem.mem_ready +
			(mem.mem_chunktime * cache->block_size / mem.mem_chunksize);
	}

	cache->buf[row].tag = tag;
```

```
	cache->buf[row].valid = 1;
	cache->buf[row].dirty = 1;

	return cumulative_miss_time;
}

int cache_read(struct cache *cache, unsigned long long addr)
{
	unsigned long long index, tag, bi;
	decompose_addr(cache, addr, &tag, &index, &bi);

	cache->cache_stats.requests++;
	cache->cache_stats.reads++;

	int row = index * cache->assoc;

	for (int i = 0; i < cache->assoc; i++) {
		int idx = buf_index(cache, index, i);
		if (cache->buf[idx].valid && cache->buf[idx].tag == tag) {
			/* Hit */
			cache->cache_stats.hits++;
			update_lru(cache, index, i);
			return cache->hit_time;
		}
	}
	/* Miss */
	int cumulative_miss_time = cache->miss_time + cache->hit_time;
	struct lru *lru = cache->lrus[index];

	while (lru->next) {
		lru = lru->next;
	}

	row = index * cache->assoc + lru->elem;
	update_lru(cache, index, lru->elem);

	if (cache->buf[row].valid) {
		cache->cache_stats.kickouts++;
		if (cache->buf[row].dirty) {
			cache->cache_stats.dirty_kickouts++;
		}
	}

	if (cache->buf[row].dirty && cache->buf[row].valid) {
		if (cache->backend) {
			unsigned long long writeaddr = compose_addr(cache,
							cache->buf[row].tag,
							index,
							bi);
			cumulative_miss_time += cache_write(cache->backend, writeaddr);
			cumulative_miss_time += cache->transfer_time *
				(cache->block_size / cache->bus_width);
		} else {
			/* Go to memory */
			cumulative_miss_time += mem.mem_sendaddr + mem.mem_ready +
				(mem.mem_chunktime * cache->block_size / mem.mem_chunksize);
		}
```

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	}

	if (cache->backend) {
		cumulative_miss_time += cache_read(cache->backend, addr);
		cumulative_miss_time += cache->transfer_time * (cache->block_size /
cache->bus_width);
	} else {
		/* Go to memory */
		cumulative_miss_time += mem.mem_sendaddr + mem.mem_ready +
			(mem.mem_chunktime * cache->block_size / mem.mem_chunksize);
	}

	cache->buf[row].tag = tag;
	cache->buf[row].valid = 1;
	cache->buf[row].dirty = 0;

	return cumulative_miss_time;
}

unsigned long long cache_flush(struct cache *cache) {
	unsigned long long cost = 0;
	for (unsigned long long i = 0; i < cache->cache_size; i++) {
		for (int j = 0; j < cache->assoc; j++) {
			struct block *b = &cache->buf[buf_index(cache, i, j)];
			if (b->dirty) {
				if (cache->backend) {
					unsigned long long writeaddr = compose_addr(cache,
b->tag, i, 0);
					cost += cache_write(cache->backend, writeaddr);
					cost += cache->transfer_time *
						(cache->block_size / cache->bus_width);
				} else {
					cost += mem.mem_sendaddr + mem.mem_ready +
						(mem.mem_chunktime *
						 cache->block_size / mem.mem_chunksize);
				}
				cache->cache_stats.flush_kickouts++;
			}
			b->valid = 0;
		}
	}
	return cost;
}

void print_cache(struct cache *cache)
{
	for (unsigned long long i = 0; i < cache->cache_size; i++) {
		for (int j = 0; j < cache->assoc; j++) {
			struct block *b = &cache->buf[buf_index(cache, i, j)];
			if (b->valid) {
				printf("Index: %#llx | V:%d D: %d Tag: %#llx\n",
					i, b->valid, b->dirty, b->tag);
			}
		}
	}
}
```

cache.h

```
/* Cache Data Structure */

#pragma once

#include <stdbool.h>

struct lru {
	int elem;
	struct lru *next;
};

struct block {
	unsigned long long tag;
	int valid;
	int dirty;
};

struct cache {
	int block_size;
	int cache_size;
	int assoc;
	int hit_time;
	int miss_time;
	int req_size;
	int transfer_time;
	int bus_width;
	int block_bits;
	int block_index_bits;
	struct {
		unsigned long long requests;
		unsigned long long hits;
		unsigned long long kickouts;
		unsigned long long dirty_kickouts;
		unsigned long long flush_kickouts;
		unsigned long long reads;
		unsigned long long writes;
	} cache_stats;
	struct block *buf;  /* Indexed by cache index then way */
	struct lru **lrus;
	struct cache *backend;
	const char *name;
};


struct stat_struct {
	unsigned long long reads;
	unsigned long long writes;
	unsigned long long insts;
	unsigned long long read_cycles;
	unsigned long long write_cycles;
	unsigned long long inst_cycles;
	unsigned long long flush_time;
	unsigned long long ideal_cycles;
	unsigned long long ideal_misaligned;
```

```
	unsigned long long flushes;
	unsigned long long invalidates;
};

extern struct cache l1_d;
extern struct cache l1_i;
extern struct cache l2;

extern struct stat_struct stats;

void init_cache(struct cache *cache);

int dispatch_write(struct cache *cache, unsigned long long addr, int bytes);
int dispatch_read(struct cache *cache, unsigned long long addr, int bytes);
int cache_write(struct cache *cache, unsigned long long addr);
int cache_read(struct cache *cache, unsigned long long addr);
void l2_l1_transfer(struct cache *l1, struct cache *l2, int l2_transfer_time, int
l2_bus_width);
void print_cache(struct cache *cache);
unsigned long long cache_flush(struct cache *cache);

static inline unsigned long long int log_2(unsigned long long int x)
{
	unsigned long long int i = 0;
	while (x != 1) { x >>= 1; i++; }
	return i;
}
```

config.c

```
/* Configuration Structure */

#include "config.h"

struct mem_config mem = {
       .mem_sendaddr = 10,
       .mem_ready = 30,
       .mem_chunktime = 15,
       .mem_chunksize = 8
};

void load_config(char *path,
               struct cache *l1_i,
               struct cache *l1_d,
               struct cache *l2,
               struct mem_config *mem,
               int *l2_transfer,
               int *l2_bus_width)
{
       FILE *file = fopen(path, "r");
       if (file == NULL) return;

       while (!feof(file)) {
              char *field = NULL;
              char c;
              size_t size = 0;
              int field_val;
              getdelim(&field, &size, '=', file);
              field[strlen(field) - 1] = '\0';
              while (isspace(c = fgetc(file)));
              ungetc(c, file);
              fscanf(file, "%d\n", &field_val);

              if (strcmp(field, "l1_block_size_i") == 0) l1_i->block_size = field_val;
              else if (strcmp(field, "l1_cache_size_i") == 0) l1_i->cache_size =
field_val;
              else if (strcmp(field, "l1_assoc_i") == 0) l1_i->assoc = field_val;
              else if (strcmp(field, "l1_hit_time_i") == 0) l1_i->hit_time = field_val;
              else if (strcmp(field, "l1_miss_time_i") == 0) l1_i->miss_time =
field_val;

              else if (strcmp(field, "l1_block_size_d") == 0) l1_d->block_size =
field_val;
              else if (strcmp(field, "l1_cache_size_d") == 0) l1_d->cache_size =
field_val;
              else if (strcmp(field, "l1_assoc_d") == 0) l1_d->assoc = field_val;
              else if (strcmp(field, "l1_hit_time_d") == 0) l1_d->hit_time = field_val;
              else if (strcmp(field, "l1_miss_time_d") == 0) l1_d->miss_time =
field_val;

              else if (strcmp(field, "l2_block_size") == 0) l2->block_size = field_val;
              else if (strcmp(field, "l2_cache_size") == 0) l2->cache_size = field_val;
              else if (strcmp(field, "l2_assoc") == 0) l2->assoc = field_val;
              else if (strcmp(field, "l2_hit_time") == 0) l2->hit_time = field_val;
```

```
            else if (strcmp(field, "l2_miss_time") == 0) l2->miss_time = field_val;

            else if (strcmp(field, "l2_transfer") == 0) *l2_transfer = field_val;
            else if (strcmp(field, "l2_bus_width") == 0) *l2_bus_width = field_val;

            else if (strcmp(field, "mem_sendaddr") == 0) mem->mem_sendaddr =
field_val;
            else if (strcmp(field, "mem_ready") == 0) mem->mem_ready = field_val;
            else if (strcmp(field, "mem_chunktime") == 0) mem->mem_chunktime =
field_val;
            else if (strcmp(field, "mem_chunksize") == 0) mem->mem_chunksize =
field_val;
            free(field);
      }

      return;
}
```

config.h

```
/* Configuration structure definition */

#pragma once

#include <stdio.h>
#include <ctype.h>
#include <string.h>
#include <stdlib.h>

#include "cache.h"

struct mem_config {
       int mem_sendaddr;
       int mem_ready;
       int mem_chunktime;
       int mem_chunksize;
};

extern struct mem_config mem;

void load_config(char *path,
               struct cache *l1_i,
               struct cache *l1_d,
               struct cache *l2,
               struct mem_config *mem,
               int *l2_transfer,
               int *l2_bus_width);
```

MAKEFILE

```
CC=gcc
CFLAGS=-Wall -g -O2 --std=gnu99
BIN=cache-sim
OBJ=main.o config.o cache.o

%.o : %.c
	$(CC) -o $@ -c $< $(CFLAGS)

$(BIN) : $(OBJ)
	$(CC) -o $(BIN) $(OBJ)

.PHONY : clean
clean :
	rm -rf $(OBJ) $(BIN)
```

```
---------------------------------------------------------------------
             bzip2.All-2way            Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 2 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 51819782329; Total References = 10000000073
Flush Time = 433215242
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
    Reads  =     1882275327    [18.8%]
    Writes =     552506959    [5.5%]
    Inst.  =     7565217787    [75.7%]
    Total  =     10000000073

Total cycles for activities: [Percentage]
    Reads  =     20125897745    [38.8%]
    Writes =     19101145576    [36.9%]
    Inst.  =     12592739008    [24.3%]
    Total  =     51819782329

Average cycles for activities:
  Read =  10.7; Write =  34.6; Inst. =  6.8
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
    Hit Count = 12095527121  Miss Count = 555401
    Total Requests = 12096082522
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 2674; Dirty Kickouts = 0; Transfers = 555401
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2378127911  Miss Count = 160072485
    Total Requests = 2538200396
    Hit Rate = 93.7%   Miss Rate = 6.3%
    Kickouts = 154979866; Dirty Kickouts = 62473522; Transfers = 161310502
    Flush Kickouts  =  1238017

Memory Level: L2
    Hit Count = 77722855  Miss Count = 146616570
    Total Requests = 224339425
    Hit Rate = 34.6%   Miss Rate = 65.4%
    Kickouts = 136811918; Dirty Kickouts = 55034587; Transfers = 148924564
    Flush Kickouts  =  2307994

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $100;   Memory Cost = $75   Total Cost = $975
Flushes = 19908 : Invalidates = 19908
```

```
---------------------------------------------------------------------
             bzip2.All-4way            Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 4 : block size = 32
    Icache Size = 8192 : ways = 4 : block size = 32
    L2-cache Size = 32768 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 51496636099; Total References = 10000000073
Flush Time = 421862981
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
    Reads  =     1882275327    [18.8%]
    Writes =     552506959    [5.5%]
    Inst.  =     7565217787    [75.7%]
    Total  =     10000000073

Total cycles for activities: [Percentage]
    Reads  =     19734976073    [38.3%]
    Writes =     19180835430    [37.2%]
    Inst.  =     12580824596    [24.4%]
    Total  =     51496636099

Average cycles for activities:
  Read =  10.5; Write =  34.7; Inst. =  6.8
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
    Hit Count = 12095527306  Miss Count = 555216
    Total Requests = 12096082522
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 1778; Dirty Kickouts = 0; Transfers = 555216
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2380037622  Miss Count = 158162774
    Total Requests = 2538200396
    Hit Rate = 93.8%   Miss Rate = 6.2%
    Kickouts = 153066463; Dirty Kickouts = 61597513; Transfers = 159395257
    Flush Kickouts  =  1232483

Memory Level: L2
    Hit Count = 75870403  Miss Count = 145677583
    Total Requests = 221547986
    Hit Rate = 34.2%   Miss Rate = 65.8%
    Kickouts = 135799719; Dirty Kickouts = 54270414; Transfers = 147983788
    Flush Kickouts  =  2306205

L1 cache cost (Icache $600) + (Dcache $600) = $1200
L2 cache cost = $150;   Memory Cost = $75   Total Cost = $1425
Flushes = 19908 : Invalidates = 19908
```

```
---------------------------------------------------------------------
             bzip2.All-FA-L2Big         Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 256 : block size = 32
    Icache Size = 8192 : ways = 256 : block size = 32
    L2-cache Size = 65536 : ways = 1024 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 47547173575; Total References = 10000000073
Flush Time = 699815829
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
    Reads  =     1882275327    [18.8%]
    Writes =     552506959    [5.5%]
    Inst.  =     7565217787    [75.7%]
    Total  =     10000000073

Total cycles for activities: [Percentage]
    Reads  =     17998338985    [37.9%]
    Writes =     16690474845    [35.1%]
    Inst.  =     12858359745    [27.0%]
    Total  =     47547173575

Average cycles for activities:
  Read =  9.6; Write =  30.2; Inst. =  6.3
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
    Hit Count = 12095527363  Miss Count = 555159
    Total Requests = 12096082522
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 1619; Dirty Kickouts = 0; Transfers = 555159
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2380877774  Miss Count = 157322622
    Total Requests = 2538200396
    Hit Rate = 93.8%   Miss Rate = 6.2%
    Kickouts = 152225918; Dirty Kickouts = 61293922; Transfers = 158531019
    Flush Kickouts  =  1208397

Memory Level: L2
    Hit Count = 97071252  Miss Count = 123308848
    Total Requests = 220380100
    Hit Rate = 44.0%   Miss Rate = 56.0%
    Kickouts = 104293878; Dirty Kickouts = 51137948; Transfers = 127525486
    Flush Kickouts  =  4216638

L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
L2 cache cost = $1100;   Memory Cost = $75   Total Cost = $4775
Flushes = 19908 : Invalidates = 19908
```

```
------------------------------------------------------------------
        bzip2.All-FA       Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 256 : block size = 32
    Icache Size = 8192 : ways = 256 : block size = 32
    L2-cache Size = 32768 : ways = 512 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 48442257007; Total References = 10000000073
Flush Time = 386255758
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
    Reads  =     1882275327    [18.8%]
    Writes =     552506959    [5.5%]
    Inst.  =     7565217787    [75.7%]
    Total  =     10000000073

Total cycles for activities: [Percentage]
    Reads  =     18850904296    [38.9%]
    Writes =     17046226134    [35.2%]
    Inst.  =     12545126577    [25.9%]
    Total  =     48442257007

Average cycles for activities:
  Read =  10.0; Write =  30.9; Inst. =  6.4
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
    Hit Count = 12095527363  Miss Count = 555159
    Total Requests = 12096082522
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 1619; Dirty Kickouts = 0; Transfers = 555159
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2380877774  Miss Count = 157322622
    Total Requests = 2538200396
    Hit Rate = 93.8%   Miss Rate = 6.2%
    Kickouts = 152225918; Dirty Kickouts = 61293922; Transfers = 158531019
    Flush Kickouts  =  1208397

Memory Level: L2
    Hit Count = 92347996  Miss Count = 128032104
    Total Requests = 220380100
    Hit Rate = 41.9%   Miss Rate = 58.1%
    Kickouts = 118091882; Dirty Kickouts = 53783404; Transfers = 130267659
    Flush Kickouts  =  2235555

L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
L2 cache cost = $500;   Memory Cost = $75   Total Cost = $4175
Flushes = 19908 : Invalidates = 19908
```

```
------------------------------------------------------------------
              bzip2.default       Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 1 : block size = 32
    Icache Size = 8192 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 53229846334; Total References = 10000000073
Flush Time = 441989198
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
    Reads  =     1882275327    [18.8%]
    Writes =     552506959    [5.5%]
    Inst.  =     7565217787    [75.7%]
    Total  =     10000000073

Total cycles for activities: [Percentage]
    Reads  =     21895048990    [41.1%]
    Writes =     18718145246    [35.2%]
    Inst.  =     12616652098    [23.7%]
    Total  =     53229846334

Average cycles for activities:
  Read =  11.6; Write =  33.9; Inst. =  7.0
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
    Hit Count = 12094754630  Miss Count = 1327892
    Total Requests = 12096082522
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 782784; Dirty Kickouts = 0; Transfers = 1327892
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2360100410  Miss Count = 178099986
    Total Requests = 2538200396
    Hit Rate = 93.0%   Miss Rate = 7.0%
    Kickouts = 173028492; Dirty Kickouts = 69160663; Transfers = 179327276
    Flush Kickouts  =  1227290

Memory Level: L2
    Hit Count = 99848952  Miss Count = 149966879
    Total Requests = 249815831
    Hit Rate = 40.0%   Miss Rate = 60.0%
    Kickouts = 140328521; Dirty Kickouts = 57867755; Transfers = 152251807
    Flush Kickouts  =  2284928

L1 cache cost (Icache $200) + (Dcache $200) = $400
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $525
Flushes = 19908 : Invalidates = 19908
```

```
------------------------------------------------------------------
              bzip2.L1-2way       Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 53432975037; Total References = 10000000073
Flush Time = 467409755
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
    Reads  =     1882275327    [18.8%]
    Writes =     552506959    [5.5%]
    Inst.  =     7565217787    [75.7%]
    Total  =     10000000073

Total cycles for activities: [Percentage]
    Reads  =     20850535313    [39.0%]
    Writes =     19954452414    [37.3%]
    Inst.  =     12627987310    [23.6%]
    Total  =     53432975037

Average cycles for activities:
  Read =  11.1; Write =  36.1; Inst. =  7.1
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
    Hit Count = 12095527121  Miss Count = 555401
    Total Requests = 12096082522
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 2674; Dirty Kickouts = 0; Transfers = 555401
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2378127911  Miss Count = 160072485
    Total Requests = 2538200396
    Hit Rate = 93.7%   Miss Rate = 6.3%
    Kickouts = 154979866; Dirty Kickouts = 62473522; Transfers = 161310502
    Flush Kickouts  =  1238017

Memory Level: L2
    Hit Count = 69101291  Miss Count = 155238134
    Total Requests = 224339425
    Hit Rate = 30.8%   Miss Rate = 69.2%
    Kickouts = 145606632; Dirty Kickouts = 56091645; Transfers = 157572767
    Flush Kickouts  =  2334633

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $925
Flushes = 19908 : Invalidates = 19908
```

```
---------------------------------------------------------------------
              bzip2.L1-8way       Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 8 : block size = 32
    Icache Size = 8192 : ways = 8 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 54033953146; Total References = 10000000073
Flush Time = 477909304
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
    Reads  =     1882275327    [18.8%]
    Writes =     552506959    [5.5%]
    Inst.  =     7565217787    [75.7%]
    Total  =     10000000073

Total cycles for activities: [Percentage]
    Reads  =     20481618899    [37.9%]
    Writes =     20913975750    [38.7%]
    Inst.  =     12638358497    [23.4%]
    Total  =     54033953146

Average cycles for activities:
  Read =  10.9; Write =  37.9; Inst. =  7.1
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
    Hit Count = 12095527356  Miss Count = 555166
    Total Requests = 12096082522
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 1662; Dirty Kickouts = 0; Transfers = 555166
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2380527294  Miss Count = 157673102
    Total Requests = 2538200396
    Hit Rate = 93.8%   Miss Rate = 6.2%
    Kickouts = 152576404; Dirty Kickouts = 61411716; Transfers = 158893683
    Flush Kickouts  =  1220581

Memory Level: L2
    Hit Count = 60944650  Miss Count = 159915915
    Total Requests = 220860565
    Hit Rate = 27.6%   Miss Rate = 72.4%
    Kickouts = 150285507; Dirty Kickouts = 55300974; Transfers = 162256039
    Flush Kickouts  =  2340124

L1 cache cost (Icache $800) + (Dcache $800) = $1600
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $1725
Flushes = 19908 : Invalidates = 19908
```

```
------------------------------------------------------------------
              bzip2.L1-small-4way        Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 4096 : ways = 4 : block size = 32
    Icache Size = 4096 : ways = 4 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 52233860859; Total References = 10000000073
Flush Time = 396237966
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
    Reads  =     1882275327    [18.8%]
    Writes =     552506959    [5.5%]
    Inst.  =     7565217787    [75.7%]
    Total  =     10000000073

Total cycles for activities: [Percentage]
    Reads  =     20419942538    [39.1%]
    Writes =     19255855327    [36.9%]
    Inst.  =     12558062994    [24.0%]
    Total  =     52233860859

Average cycles for activities:
  Read =  10.8; Write =  34.9; Inst. =  6.9
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
    Hit Count = 12095521667  Miss Count = 560855
    Total Requests = 12096082522
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 14688; Dirty Kickouts = 0; Transfers = 560855
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2371554001  Miss Count = 166646395
    Total Requests = 2538200396
    Hit Rate = 93.4%   Miss Rate = 6.6%
    Kickouts = 164098043; Dirty Kickouts = 65157952; Transfers = 167302934
    Flush Kickouts  =  656539

Memory Level: L2
    Hit Count = 85319053  Miss Count = 147702688
    Total Requests = 233021741
    Hit Rate = 36.6%   Miss Rate = 63.4%
    Kickouts = 138072280; Dirty Kickouts = 55700386; Transfers = 149944150
    Flush Kickouts  =  2241462

L1 cache cost (Icache $300) + (Dcache $300) = $600
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $725
Flushes = 19908 : Invalidates = 19908
```

```
---------------------------------------------------------------------
             bzip2.L1-small            Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 4096 : ways = 1 : block size = 32
    Icache Size = 4096 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 52644387374; Total References = 10000000073
Flush Time = 379842296
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
    Reads  =     1882275327    [18.8%]
    Writes =     552506959    [5.5%]
    Inst.  =     7565217787    [75.7%]
    Total  =     10000000073

Total cycles for activities: [Percentage]
    Reads  =     21895601747    [41.6%]
    Writes =     18192564325    [34.6%]
    Inst.  =     12556221302    [23.9%]
    Total  =     52644387374

Average cycles for activities:
  Read =  11.6; Write =  32.9; Inst. =  7.0
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
    Hit Count = 12094746128  Miss Count = 1336394
    Total Requests = 12096082522
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 795936; Dirty Kickouts = 0; Transfers = 1336394
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2335018951  Miss Count = 203181445
    Total Requests = 2538200396
    Hit Rate = 92.0%   Miss Rate = 8.0%
    Kickouts = 200633399; Dirty Kickouts = 78562930; Transfers = 203824926
    Flush Kickouts  =  643481

Memory Level: L2
    Hit Count = 139961829  Miss Count = 143762421
    Total Requests = 283724250
    Hit Rate = 49.3%   Miss Rate = 50.7%
    Kickouts = 134131951; Dirty Kickouts = 57422952; Transfers = 145973210
    Flush Kickouts  =  2210789

L1 cache cost (Icache $100) + (Dcache $100) = $200
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $325
Flushes = 19908 : Invalidates = 19908
```

```
---------------------------------------------------------------------
              bzip2.L2-4way       Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 50663293201; Total References = 10000000073
Flush Time = 413066249
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
    Reads  =     1882275327    [18.8%]
    Writes =     552506959    [5.5%]
    Inst.  =     7565217787    [75.7%]
    Total  =     10000000073

Total cycles for activities: [Percentage]
    Reads  =     19733728397    [39.0%]
    Writes =     18357491690    [36.2%]
    Inst.  =     12572073114    [24.8%]
    Total  =     50663293201

Average cycles for activities:
  Read =  10.5; Write =  33.2; Inst. =  6.7
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
    Hit Count = 12095527121  Miss Count = 555401
    Total Requests = 12096082522
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 2674; Dirty Kickouts = 0; Transfers = 555401
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2378127911  Miss Count = 160072485
    Total Requests = 2538200396
    Hit Rate = 93.7%   Miss Rate = 6.3%
    Kickouts = 154979866; Dirty Kickouts = 62473522; Transfers = 161310502
    Flush Kickouts  =  1238017

Memory Level: L2
    Hit Count = 84023199  Miss Count = 140316226
    Total Requests = 224339425
    Hit Rate = 37.5%   Miss Rate = 62.5%
    Kickouts = 130437115; Dirty Kickouts = 54399060; Transfers = 142607674
    Flush Kickouts  =  2291448

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $150;   Memory Cost = $75   Total Cost = $1025
Flushes = 19908 : Invalidates = 19908
```

```
------------------------------------------------------------------
              bzip2.L2-Big        Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 65536 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 50688508881; Total References = 10000000073
Flush Time = 778791783
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
    Reads  =     1882275327    [18.8%]
    Writes =     552506959    [5.5%]
    Inst.  =     7565217787    [75.7%]
    Total  =     10000000073

Total cycles for activities: [Percentage]
    Reads  =     19420268992    [38.3%]
    Writes =     18329566826    [36.2%]
    Inst.  =     12938673063    [25.5%]
    Total  =     50688508881

Average cycles for activities:
  Read =  10.3; Write =  33.2; Inst. =  6.7
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
    Hit Count = 12095527121  Miss Count = 555401
    Total Requests = 12096082522
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 2674; Dirty Kickouts = 0; Transfers = 555401
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2378127911  Miss Count = 160072485
    Total Requests = 2538200396
    Hit Rate = 93.7%   Miss Rate = 6.3%
    Kickouts = 154979866; Dirty Kickouts = 62473522; Transfers = 161310502
    Flush Kickouts  =  1238017

Memory Level: L2
    Hit Count = 84348159  Miss Count = 139991266
    Total Requests = 224339425
    Hit Rate = 37.6%   Miss Rate = 62.4%
    Kickouts = 121764126; Dirty Kickouts = 52709652; Transfers = 144468897
    Flush Kickouts  =  4477631

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $100;   Memory Cost = $75   Total Cost = $975
Flushes = 19908 : Invalidates = 19908
```

```
---------------------------------------------------------------------
             h264ref.All-2way          Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 2 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 26737444589; Total References = 10000000106
Flush Time = 546702272
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
    Reads  =     2689845793    [26.9%]
    Writes =     580065162    [5.8%]
    Inst.  =     6730089151    [67.3%]
    Total  =     10000000106

Total cycles for activities: [Percentage]
    Reads  =     9273316723    [34.7%]
    Writes =     2620034214    [9.8%]
    Inst.  =     14844093652    [55.5%]
    Total  =     26737444589

Average cycles for activities:
  Read =  3.4; Write =  4.5; Inst. =  4.0
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
    Hit Count = 11160285566  Miss Count = 47791322
    Total Requests = 11208076888
    Hit Rate = 99.6%   Miss Rate = 0.4%
    Kickouts = 44719492; Dirty Kickouts = 0; Transfers = 47791322
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3940990857  Miss Count = 83744469
    Total Requests = 4024735326
    Hit Rate = 97.9%   Miss Rate = 2.1%
    Kickouts = 79223864; Dirty Kickouts = 20672723; Transfers = 85245282
    Flush Kickouts  =  1500813

Memory Level: L2
    Hit Count = 108534830  Miss Count = 45174497
    Total Requests = 153709327
    Hit Rate = 70.6%   Miss Rate = 29.4%
    Kickouts = 37064087; Dirty Kickouts = 6420161; Transfers = 48275059
    Flush Kickouts  =  3100562

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $100;   Memory Cost = $75   Total Cost = $975
Flushes = 17710 : Invalidates = 17710
```

```
---------------------------------------------------------------------
              h264ref.All-4way           Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 4 : block size = 32
    Icache Size = 8192 : ways = 4 : block size = 32
    L2-cache Size = 32768 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 24941395329; Total References = 10000000106
Flush Time = 533608951
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
    Reads  =     2689845793    [26.9%]
    Writes =     580065162    [5.8%]
    Inst.  =     6730089151    [67.3%]
    Total  =     10000000106

Total cycles for activities: [Percentage]
    Reads  =     8151351391    [32.7%]
    Writes =     2452092271    [9.8%]
    Inst.  =     14337951667    [57.5%]
    Total  =     24941395329

Average cycles for activities:
  Read =  3.0; Write =  4.2; Inst. =  3.7
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
    Hit Count = 11159355699  Miss Count = 48721189
    Total Requests = 11208076888
    Hit Rate = 99.6%   Miss Rate = 0.4%
    Kickouts = 45599000; Dirty Kickouts = 0; Transfers = 48721189
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3962032699  Miss Count = 62702627
    Total Requests = 4024735326
    Hit Rate = 98.4%   Miss Rate = 1.6%
    Kickouts = 58175096; Dirty Kickouts = 15514970; Transfers = 64163345
    Flush Kickouts  =  1460718

Memory Level: L2
    Hit Count = 90184507  Miss Count = 38214997
    Total Requests = 128399504
    Hit Rate = 70.2%   Miss Rate = 29.8%
    Kickouts = 29865470; Dirty Kickouts = 5001095; Transfers = 41271791
    Flush Kickouts  =  3056794

L1 cache cost (Icache $600) + (Dcache $600) = $1200
L2 cache cost = $150;   Memory Cost = $75   Total Cost = $1425
Flushes = 17710 : Invalidates = 17710
```

```
---------------------------------------------------------------------
              h264ref.All-FA-L2Big       Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 256 : block size = 32
    Icache Size = 8192 : ways = 256 : block size = 32
    L2-cache Size = 65536 : ways = 1024 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 22840693845; Total References = 10000000106
Flush Time = 885847232
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
    Reads  =     2689845793    [26.9%]
    Writes =     580065162    [5.8%]
    Inst.  =     6730089151    [67.3%]
    Total  =     10000000106

Total cycles for activities: [Percentage]
    Reads  =     6977778138    [30.5%]
    Writes =     2107720234    [9.2%]
    Inst.  =     13755195473    [60.2%]
    Total  =     22840693845

Average cycles for activities:
  Read =  2.6; Write =  3.6; Inst. =  3.4
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
    Hit Count = 11151277315  Miss Count = 56799573
    Total Requests = 11208076888
    Hit Rate = 99.5%   Miss Rate = 0.5%
    Kickouts = 53642588; Dirty Kickouts = 0; Transfers = 56799573
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3968992020  Miss Count = 55743306
    Total Requests = 4024735326
    Hit Rate = 98.6%   Miss Rate = 1.4%
    Kickouts = 51209295; Dirty Kickouts = 13315680; Transfers = 57201076
    Flush Kickouts  =  1457770

Memory Level: L2
    Hit Count = 101221098  Miss Count = 26095231
    Total Requests = 127316329
    Hit Rate = 79.5%   Miss Rate = 20.5%
    Kickouts = 11583346; Dirty Kickouts = 2284382; Transfers = 31483913
    Flush Kickouts  =  5388682

L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
L2 cache cost = $1100;   Memory Cost = $75   Total Cost = $4775
Flushes = 17710 : Invalidates = 17710
```

```
------------------------------------------------------------------
        h264ref.All-FA       Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 256 : block size = 32
    Icache Size = 8192 : ways = 256 : block size = 32
    L2-cache Size = 32768 : ways = 512 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 23773292479; Total References = 10000000106
Flush Time = 523542340
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
    Reads  =     2689845793    [26.9%]
    Writes =     580065162    [5.8%]
    Inst.  =     6730089151    [67.3%]
    Total  =     10000000106

Total cycles for activities: [Percentage]
    Reads  =     7719133381    [32.5%]
    Writes =     2287924120    [9.6%]
    Inst.  =     13766234978    [57.9%]
    Total  =     23773292479

Average cycles for activities:
  Read =  2.9; Write =  3.9; Inst. =  3.5
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
    Hit Count = 11151277315  Miss Count = 56799573
    Total Requests = 11208076888
    Hit Rate = 99.5%   Miss Rate = 0.5%
    Kickouts = 53642588; Dirty Kickouts = 0; Transfers = 56799573
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3968992020  Miss Count = 55743306
    Total Requests = 4024735326
    Hit Rate = 98.6%   Miss Rate = 1.4%
    Kickouts = 51209295; Dirty Kickouts = 13315680; Transfers = 57201076
    Flush Kickouts  =  1457770

Memory Level: L2
    Hit Count = 95100196  Miss Count = 32216133
    Total Requests = 127316329
    Hit Rate = 74.7%   Miss Rate = 25.3%
    Kickouts = 23685824; Dirty Kickouts = 4087901; Transfers = 35241346
    Flush Kickouts  =  3025213

L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
L2 cache cost = $500;   Memory Cost = $75   Total Cost = $4175
Flushes = 17710 : Invalidates = 17710
```

```
-------------------------------------------------------------------
              h264ref.default            Simulation Results
-------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 1 : block size = 32
    Icache Size = 8192 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 34846661121; Total References = 10000000106
Flush Time = 528850737
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
    Reads  =     2689845793    [26.9%]
    Writes =     580065162    [5.8%]
    Inst.  =     6730089151    [67.3%]
    Total  =     10000000106

Total cycles for activities: [Percentage]
    Reads  =     14922442972    [42.8%]
    Writes =     3968790793    [11.4%]
    Inst.  =     15955427356    [45.8%]
    Total  =     34846661121

Average cycles for activities:
  Read =  5.5; Write =  6.8; Inst. =  5.2
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
    Hit Count = 11154941079  Miss Count = 53135809
    Total Requests = 11208076888
    Hit Rate = 99.5%   Miss Rate = 0.5%
    Kickouts = 50182354; Dirty Kickouts = 0; Transfers = 53135809
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3856443351  Miss Count = 168291975
    Total Requests = 4024735326
    Hit Rate = 95.8%   Miss Rate = 4.2%
    Kickouts = 163794819; Dirty Kickouts = 43415363; Transfers = 169865389
    Flush Kickouts  =  1573414

Memory Level: L2
    Hit Count = 190008917  Miss Count = 76407644
    Total Requests = 266416561
    Hit Rate = 71.3%   Miss Rate = 28.7%
    Kickouts = 68833012; Dirty Kickouts = 13533180; Transfers = 79350065
    Flush Kickouts  =  2942421

L1 cache cost (Icache $200) + (Dcache $200) = $400
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $525
Flushes = 17710 : Invalidates = 17710
```

```
---------------------------------------------------------------------
              h264ref.L1-2way            Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 28855988887; Total References = 10000000106
Flush Time = 564519847
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
    Reads  =     2689845793    [26.9%]
    Writes =     580065162    [5.8%]
    Inst.  =     6730089151    [67.3%]
    Total  =     10000000106

Total cycles for activities: [Percentage]
    Reads  =     10406613203    [36.1%]
    Writes =     3080549312    [10.7%]
    Inst.  =     15368826372    [53.3%]
    Total  =     28855988887

Average cycles for activities:
  Read =  3.9; Write =  5.3; Inst. =  4.3
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
    Hit Count = 11160285566  Miss Count = 47791322
    Total Requests = 11208076888
    Hit Rate = 99.6%   Miss Rate = 0.4%
    Kickouts = 44719492; Dirty Kickouts = 0; Transfers = 47791322
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3940990857  Miss Count = 83744469
    Total Requests = 4024735326
    Hit Rate = 97.9%   Miss Rate = 2.1%
    Kickouts = 79223864; Dirty Kickouts = 20672723; Transfers = 85245282
    Flush Kickouts  =  1500813

Memory Level: L2
    Hit Count = 98287016  Miss Count = 55422311
    Total Requests = 153709327
    Hit Rate = 63.9%   Miss Rate = 36.1%
    Kickouts = 47854037; Dirty Kickouts = 9015757; Transfers = 58472023
    Flush Kickouts  =  3049712

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $925
Flushes = 17710 : Invalidates = 17710
```

```
--------------------------------------------------------------------
              h264ref.L1-8way           Simulation Results
--------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 8 : block size = 32
    Icache Size = 8192 : ways = 8 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 26539400338; Total References = 10000000106
Flush Time = 583017998
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
    Reads  =     2689845793    [26.9%]
    Writes =     580065162    [5.8%]
    Inst.  =     6730089151    [67.3%]
    Total  =     10000000106

Total cycles for activities: [Percentage]
    Reads  =     8738461787    [32.9%]
    Writes =     2486986995    [9.4%]
    Inst.  =     15313951556    [57.7%]
    Total  =     26539400338

Average cycles for activities:
  Read =  3.2; Write =  4.3; Inst. =  3.9
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
    Hit Count = 11156202045  Miss Count = 51874843
    Total Requests = 11208076888
    Hit Rate = 99.5%   Miss Rate = 0.5%
    Kickouts = 48728875; Dirty Kickouts = 0; Transfers = 51874843
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3967117006  Miss Count = 57618320
    Total Requests = 4024735326
    Hit Rate = 98.6%   Miss Rate = 1.4%
    Kickouts = 53087007; Dirty Kickouts = 13905536; Transfers = 59055208
    Flush Kickouts  =  1436888

Memory Level: L2
    Hit Count = 77849639  Miss Count = 46985948
    Total Requests = 124835587
    Hit Rate = 62.4%   Miss Rate = 37.6%
    Kickouts = 39418613; Dirty Kickouts = 6132752; Transfers = 50090120
    Flush Kickouts  =  3104172

L1 cache cost (Icache $800) + (Dcache $800) = $1600
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $1725
Flushes = 17710 : Invalidates = 17710
```

```
---------------------------------------------------------------------
             h264ref.L1-small-4way            Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 4096 : ways = 4 : block size = 32
    Icache Size = 4096 : ways = 4 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 31459829393; Total References = 10000000106
Flush Time = 476672396
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
    Reads  =     2689845793    [26.9%]
    Writes =     580065162    [5.8%]
    Inst.  =     6730089151    [67.3%]
    Total  =     10000000106

Total cycles for activities: [Percentage]
    Reads  =     11583795195    [36.8%]
    Writes =     3274434243    [10.4%]
    Inst.  =     16601599955    [52.8%]
    Total  =     31459829393

Average cycles for activities:
  Read =  4.3; Write =  5.6; Inst. =  4.7
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
    Hit Count = 11142436561  Miss Count = 65640327
    Total Requests = 11208076888
    Hit Rate = 99.4%   Miss Rate = 0.6%
    Kickouts = 63953917; Dirty Kickouts = 0; Transfers = 65640327
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3902136074  Miss Count = 122599252
    Total Requests = 4024735326
    Hit Rate = 97.0%   Miss Rate = 3.0%
    Kickouts = 120332251; Dirty Kickouts = 28040657; Transfers = 123209089
    Flush Kickouts  =  609837

Memory Level: L2
    Hit Count = 153586378  Miss Count = 63303695
    Total Requests = 216890073
    Hit Rate = 70.8%   Miss Rate = 29.2%
    Kickouts = 55736379; Dirty Kickouts = 11028035; Transfers = 66111344
    Flush Kickouts  =  2807649

L1 cache cost (Icache $300) + (Dcache $300) = $600
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $725
Flushes = 17710 : Invalidates = 17710
```

```
---------------------------------------------------------------------
             h264ref.L1-small          Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 4096 : ways = 1 : block size = 32
    Icache Size = 4096 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 38317937080; Total References = 10000000106
Flush Time = 467519087
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
    Reads  =     2689845793    [26.9%]
    Writes =     580065162    [5.8%]
    Inst.  =     6730089151    [67.3%]
    Total  =     10000000106

Total cycles for activities: [Percentage]
    Reads  =     16703397888    [43.6%]
    Writes =     4433243116    [11.6%]
    Inst.  =     17181296076    [44.8%]
    Total  =     38317937080

Average cycles for activities:
  Read =  6.2; Write =  7.6; Inst. =  5.7
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
    Hit Count = 11122010646  Miss Count = 86066242
    Total Requests = 11208076888
    Hit Rate = 99.2%   Miss Rate = 0.8%
    Kickouts = 84402310; Dirty Kickouts = 0; Transfers = 86066242
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3767873369  Miss Count = 256861957
    Total Requests = 4024735326
    Hit Rate = 93.6%   Miss Rate = 6.4%
    Kickouts = 254596737; Dirty Kickouts = 65962984; Transfers = 257515611
    Flush Kickouts  =  653654

Memory Level: L2
    Hit Count = 327114101  Miss Count = 82430736
    Total Requests = 409544837
    Hit Rate = 79.9%   Miss Rate = 20.1%
    Kickouts = 74863250; Dirty Kickouts = 14915693; Transfers = 85221863
    Flush Kickouts  =  2791127

L1 cache cost (Icache $100) + (Dcache $100) = $200
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $325
Flushes = 17710 : Invalidates = 17710
```

```
---------------------------------------------------------------------
              h264ref.L2-4way            Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 25429376742; Total References = 10000000106
Flush Time = 528472148
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
    Reads  =     2689845793    [26.9%]
    Writes =     580065162    [5.8%]
    Inst.  =     6730089151    [67.3%]
    Total  =     10000000106

Total cycles for activities: [Percentage]
    Reads  =     8490795943    [33.4%]
    Writes =     2543129242    [10.0%]
    Inst.  =     14395451557    [56.6%]
    Total  =     25429376742

Average cycles for activities:
  Read =  3.2; Write =  4.4; Inst. =  3.8
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
    Hit Count = 11160285566  Miss Count = 47791322
    Total Requests = 11208076888
    Hit Rate = 99.6%   Miss Rate = 0.4%
    Kickouts = 44719492; Dirty Kickouts = 0; Transfers = 47791322
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3940990857  Miss Count = 83744469
    Total Requests = 4024735326
    Hit Rate = 97.9%   Miss Rate = 2.1%
    Kickouts = 79223864; Dirty Kickouts = 20672723; Transfers = 85245282
    Flush Kickouts  =  1500813

Memory Level: L2
    Hit Count = 115076271  Miss Count = 38633056
    Total Requests = 153709327
    Hit Rate = 74.9%   Miss Rate = 25.1%
    Kickouts = 30282656; Dirty Kickouts = 5127217; Transfers = 41678767
    Flush Kickouts  =  3045711

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $150;   Memory Cost = $75   Total Cost = $1025
Flushes = 17710 : Invalidates = 17710
```

```
---------------------------------------------------------------------
             h264ref.L2-Big            Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 65536 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 26596202549; Total References = 10000000106
Flush Time = 960029601
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
    Reads  =     2689845793    [26.9%]
    Writes =     580065162    [5.8%]
    Inst.  =     6730089151    [67.3%]
    Total  =     10000000106

Total cycles for activities: [Percentage]
    Reads  =     8949553517    [33.6%]
    Writes =     2778620409    [10.4%]
    Inst.  =     14868028623    [55.9%]
    Total  =     26596202549

Average cycles for activities:
  Read =  3.3; Write =  4.8; Inst. =  4.0
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
    Hit Count = 11160285566  Miss Count = 47791322
    Total Requests = 11208076888
    Hit Rate = 99.6%   Miss Rate = 0.4%
    Kickouts = 44719492; Dirty Kickouts = 0; Transfers = 47791322
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3940990857  Miss Count = 83744469
    Total Requests = 4024735326
    Hit Rate = 97.9%   Miss Rate = 2.1%
    Kickouts = 79223864; Dirty Kickouts = 20672723; Transfers = 85245282
    Flush Kickouts  =  1500813

Memory Level: L2
    Hit Count = 111381910  Miss Count = 42327417
    Total Requests = 153709327
    Hit Rate = 72.5%   Miss Rate = 27.5%
    Kickouts = 30302916; Dirty Kickouts = 5996263; Transfers = 47940754
    Flush Kickouts  =  5613337

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $100;   Memory Cost = $75   Total Cost = $975
Flushes = 17710 : Invalidates = 17710
```

```
--------------------------------------------------------------------
              libquantum.All-2way        Simulation Results
--------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 2 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 105996884457; Total References = 16506492546
Flush Time = 1270469867
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
    Reads  =     3526260463    [21.4%]
    Writes =     492653573    [3.0%]
    Inst.  =     12487578510    [75.7%]
    Total  =     16506492546

Total cycles for activities: [Percentage]
    Reads  =     86764716181    [81.9%]
    Writes =     1197968976    [1.1%]
    Inst.  =     18034199300    [17.0%]
    Total  =     105996884457

Average cycles for activities:
  Read =  24.6; Write =  2.4; Inst. =  8.5
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
    Hit Count = 16620543263  Miss Count = 845790
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 4867; Dirty Kickouts = 0; Transfers = 845790
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 6262666441  Miss Count = 576950556
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 568537628; Dirty Kickouts = 234411130; Transfers = 580300116
    Flush Kickouts  =  3349560

Memory Level: L2
    Hit Count = 526028653  Miss Count = 289528383
    Total Requests = 815557036
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 272742875; Dirty Kickouts = 125971716; Transfers = 297140958
    Flush Kickouts  =  7612575

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $100;   Memory Cost = $75   Total Cost = $975
Flushes = 32862 : Invalidates = 32862
```

```
--------------------------------------------------------------------
              libquantum.All-4way        Simulation Results
--------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 4 : block size = 32
    Icache Size = 8192 : ways = 4 : block size = 32
    L2-cache Size = 32768 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 105985252430; Total References = 16506492546
Flush Time = 1270207822
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
    Reads  =     3526260463    [21.4%]
    Writes =     492653573    [3.0%]
    Inst.  =     12487578510    [75.7%]
    Total  =     16506492546

Total cycles for activities: [Percentage]
    Reads  =     86756713433    [81.9%]
    Writes =     1196009137    [1.1%]
    Inst.  =     18032529860    [17.0%]
    Total  =     105985252430

Average cycles for activities:
  Read =  24.6; Write =  2.4; Inst. =  8.5
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
    Hit Count = 16620543782  Miss Count = 845271
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 2622; Dirty Kickouts = 0; Transfers = 845271
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 6262710581  Miss Count = 576906416
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 568493488; Dirty Kickouts = 234391405; Transfers = 580255616
    Flush Kickouts  =  3349200

Memory Level: L2
    Hit Count = 526012853  Miss Count = 289479439
    Total Requests = 815492292
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 272693097; Dirty Kickouts = 125957695; Transfers = 297090769
    Flush Kickouts  =  7611330

L1 cache cost (Icache $600) + (Dcache $600) = $1200
L2 cache cost = $150;   Memory Cost = $75   Total Cost = $1425
Flushes = 32862 : Invalidates = 32862
```

```
---------------------------------------------------------------------
              libquantum.All-FA-L2Big          Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 256 : block size = 32
    Icache Size = 8192 : ways = 256 : block size = 32
    L2-cache Size = 65536 : ways = 1024 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 106054181431; Total References = 16506492546
Flush Time = 2526475237
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
    Reads  =     3526260463    [21.4%]
    Writes =     492653573    [3.0%]
    Inst.  =     12487578510    [75.7%]
    Total  =     16506492546

Total cycles for activities: [Percentage]
    Reads  =     85584741291    [80.7%]
    Writes =     1183802981    [1.1%]
    Inst.  =     19285637159    [18.2%]
    Total  =     106054181431

Average cycles for activities:
  Read =  24.3; Write =  2.4; Inst. =  8.5
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
    Hit Count = 16620543918  Miss Count = 845135
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 2003; Dirty Kickouts = 0; Transfers = 845135
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 6262710634  Miss Count = 576906363
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 568493435; Dirty Kickouts = 234391076; Transfers = 580255703
    Flush Kickouts  =  3349340

Memory Level: L2
    Hit Count = 526064775  Miss Count = 289427139
    Total Requests = 815491914
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 256463250; Dirty Kickouts = 118578619; Transfers = 304902976
    Flush Kickouts  =  15475837

L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
L2 cache cost = $1100;   Memory Cost = $75   Total Cost = $4775
Flushes = 32862 : Invalidates = 32862
```

```
------------------------------------------------------------------
        libquantum.All-FA       Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 256 : block size = 32
    Icache Size = 8192 : ways = 256 : block size = 32
    L2-cache Size = 32768 : ways = 512 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 105986739634; Total References = 16506492546
Flush Time = 1311313221
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
    Reads  =     3526260463    [21.4%]
    Writes =     492653573    [3.0%]
    Inst.  =     12487578510    [75.7%]
    Total  =     16506492546

Total cycles for activities: [Percentage]
    Reads  =     86716884160    [81.8%]
    Writes =     1196199205    [1.1%]
    Inst.  =     18073656269    [17.1%]
    Total  =     105986739634

Average cycles for activities:
  Read =  24.6; Write =  2.4; Inst. =  8.5
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
    Hit Count = 16620543918  Miss Count = 845135
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 2003; Dirty Kickouts = 0; Transfers = 845135
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 6262710634  Miss Count = 576906363
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 568493435; Dirty Kickouts = 234391076; Transfers = 580255703
    Flush Kickouts  =  3349340

Memory Level: L2
    Hit Count = 526017146  Miss Count = 289474768
    Total Requests = 815491914
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 272684960; Dirty Kickouts = 125714276; Transfers = 297343724
    Flush Kickouts  =  7868956

L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
L2 cache cost = $500;   Memory Cost = $75   Total Cost = $4175
Flushes = 32862 : Invalidates = 32862
```

```
------------------------------------------------------------------
              libquantum.default         Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 1 : block size = 32
    Icache Size = 8192 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 107011574449; Total References = 16506492546
Flush Time = 1269477138
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
    Reads  =     3526260463    [21.4%]
    Writes =     492653573    [3.0%]
    Inst.  =     12487578510    [75.7%]
    Total  =     16506492546

Total cycles for activities: [Percentage]
    Reads  =     87652198593    [81.9%]
    Writes =     1342072202    [1.3%]
    Inst.  =     18017303654    [16.8%]
    Total  =     107011574449

Average cycles for activities:
  Read =  24.9; Write =  2.7; Inst. =  8.6
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
    Hit Count = 16620542016  Miss Count = 847037
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 8019; Dirty Kickouts = 0; Transfers = 847037
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 6253479206  Miss Count = 586137791
    Total Requests = 6839616997
    Hit Rate = 91.4%   Miss Rate = 8.6%
    Kickouts = 577724863; Dirty Kickouts = 236116182; Transfers = 589493802
    Flush Kickouts  =  3356011

Memory Level: L2
    Hit Count = 533053853  Miss Count = 293403168
    Total Requests = 826457021
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 276756337; Dirty Kickouts = 127193832; Transfers = 301011831
    Flush Kickouts  =  7608663

L1 cache cost (Icache $200) + (Dcache $200) = $400
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $525
Flushes = 32862 : Invalidates = 32862
```

```
---------------------------------------------------------------------
              libquantum.L1-2way         Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 106167201170; Total References = 16506492546
Flush Time = 1299802585
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
    Reads  =     3526260463    [21.4%]
    Writes =     492653573    [3.0%]
    Inst.  =     12487578510    [75.7%]
    Total  =     16506492546

Total cycles for activities: [Percentage]
    Reads  =     86876076402    [81.8%]
    Writes =     1243516735    [1.2%]
    Inst.  =     18047608033    [17.0%]
    Total  =     106167201170

Average cycles for activities:
  Read =  24.6; Write =  2.5; Inst. =  8.5
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
    Hit Count = 16620543263  Miss Count = 845790
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 4867; Dirty Kickouts = 0; Transfers = 845790
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 6262666441  Miss Count = 576950556
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 568537628; Dirty Kickouts = 234411130; Transfers = 580300116
    Flush Kickouts  =  3349560

Memory Level: L2
    Hit Count = 525264574  Miss Count = 290292462
    Total Requests = 815557036
    Hit Rate = 64.4%   Miss Rate = 35.6%
    Kickouts = 273645631; Dirty Kickouts = 126080439; Transfers = 298063286
    Flush Kickouts  =  7770824

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $925
Flushes = 32862 : Invalidates = 32862
```

```
---------------------------------------------------------------------
              libquantum.L1-8way         Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 8 : block size = 32
    Icache Size = 8192 : ways = 8 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 106147898462; Total References = 16506492546
Flush Time = 1300500473
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
    Reads  =     3526260463    [21.4%]
    Writes =     492653573    [3.0%]
    Inst.  =     12487578510    [75.7%]
    Total  =     16506492546

Total cycles for activities: [Percentage]
    Reads  =     86878854466    [81.8%]
    Writes =     1220847119    [1.2%]
    Inst.  =     18048196877    [17.0%]
    Total  =     106147898462

Average cycles for activities:
  Read =  24.6; Write =  2.5; Inst. =  8.5
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
    Hit Count = 16620543923  Miss Count = 845130
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 2143; Dirty Kickouts = 0; Transfers = 845130
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 6262710638  Miss Count = 576906359
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 568493431; Dirty Kickouts = 234390955; Transfers = 580255896
    Flush Kickouts  =  3349537

Memory Level: L2
    Hit Count = 525227557  Miss Count = 290264424
    Total Requests = 815491981
    Hit Rate = 64.4%   Miss Rate = 35.6%
    Kickouts = 273617593; Dirty Kickouts = 125995228; Transfers = 298035461
    Flush Kickouts  =  7771037

L1 cache cost (Icache $800) + (Dcache $800) = $1600
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $1725
Flushes = 32862 : Invalidates = 32862
```

```
---------------------------------------------------------------------
              libquantum.L1-small-4way         Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 4096 : ways = 4 : block size = 32
    Icache Size = 4096 : ways = 4 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 106093255998; Total References = 16506492546
Flush Time = 1271521524
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
    Reads  =     3526260463    [21.4%]
    Writes =     492653573    [3.0%]
    Inst.  =     12487578510    [75.7%]
    Total  =     16506492546

Total cycles for activities: [Percentage]
    Reads  =     86829370336    [81.8%]
    Writes =     1232275937    [1.2%]
    Inst.  =     18031609725    [17.0%]
    Total  =     106093255998

Average cycles for activities:
  Read =  24.6; Write =  2.5; Inst. =  8.5
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
    Hit Count = 16620542752  Miss Count = 846301
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 6062; Dirty Kickouts = 0; Transfers = 846301
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 6262691983  Miss Count = 576925014
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 572718550; Dirty Kickouts = 236079319; Transfers = 578587544
    Flush Kickouts  =  1662530

Memory Level: L2
    Hit Count = 525554025  Miss Count = 289959139
    Total Requests = 815513164
    Hit Rate = 64.4%   Miss Rate = 35.6%
    Kickouts = 273312308; Dirty Kickouts = 125975791; Transfers = 297724629
    Flush Kickouts  =  7765490

L1 cache cost (Icache $300) + (Dcache $300) = $600
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $725
Flushes = 32862 : Invalidates = 32862
```

```
------------------------------------------------------------------
              libquantum.L1-small        Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 4096 : ways = 1 : block size = 32
    Icache Size = 4096 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 107074641352; Total References = 16506492546
Flush Time = 1241918510
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
    Reads  =     3526260463    [21.4%]
    Writes =     492653573    [3.0%]
    Inst.  =     12487578510    [75.7%]
    Total  =     16506492546

Total cycles for activities: [Percentage]
    Reads  =     87735760857    [81.9%]
    Writes =     1335196035    [1.2%]
    Inst.  =     18003684460    [16.8%]
    Total  =     107074641352

Average cycles for activities:
  Read =  24.9; Write =  2.7; Inst. =  8.6
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
    Hit Count = 16620528007  Miss Count = 861046
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 69048; Dirty Kickouts = 0; Transfers = 861046
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 6246272761  Miss Count = 593344236
    Total Requests = 6839616997
    Hit Rate = 91.3%   Miss Rate = 8.7%
    Kickouts = 589137772; Dirty Kickouts = 238794548; Transfers = 595009714
    Flush Kickouts  =  1665478

Memory Level: L2
    Hit Count = 541559868  Miss Count = 293105440
    Total Requests = 834665308
    Hit Rate = 64.9%   Miss Rate = 35.1%
    Kickouts = 276458609; Dirty Kickouts = 127091825; Transfers = 300706377
    Flush Kickouts  =  7600937

L1 cache cost (Icache $100) + (Dcache $100) = $200
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $325
Flushes = 32862 : Invalidates = 32862
```

```
------------------------------------------------------------------
              libquantum.L2-4way         Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 105986391596; Total References = 16506492546
Flush Time = 1269943452
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
    Reads  =     3526260463    [21.4%]
    Writes =     492653573    [3.0%]
    Inst.  =     12487578510    [75.7%]
    Total  =     16506492546

Total cycles for activities: [Percentage]
    Reads  =     86757450906    [81.9%]
    Writes =     1196597459    [1.1%]
    Inst.  =     18032343231    [17.0%]
    Total  =     105986391596

Average cycles for activities:
  Read =  24.6; Write =  2.4; Inst. =  8.5
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
    Hit Count = 16620543263  Miss Count = 845790
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 4867; Dirty Kickouts = 0; Transfers = 845790
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 6262666441  Miss Count = 576950556
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 568537628; Dirty Kickouts = 234411130; Transfers = 580300116
    Flush Kickouts  =  3349560

Memory Level: L2
    Hit Count = 526078216  Miss Count = 289478820
    Total Requests = 815557036
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 272692478; Dirty Kickouts = 125959922; Transfers = 297089340
    Flush Kickouts  =  7610520

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $150;   Memory Cost = $75   Total Cost = $1025
Flushes = 32862 : Invalidates = 32862
```

```
---------------------------------------------------------------------
              libquantum.L2-Big          Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 65536 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 106193664187; Total References = 16506492546
Flush Time = 2538193352
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
    Reads  =     3526260463    [21.4%]
    Writes =     492653573    [3.0%]
    Inst.  =     12487578510    [75.7%]
    Total  =     16506492546

Total cycles for activities: [Percentage]
    Reads  =     85686604636    [80.7%]
    Writes =     1217720961    [1.1%]
    Inst.  =     19289338590    [18.2%]
    Total  =     106193664187

Average cycles for activities:
  Read =  24.3; Write =  2.5; Inst. =  8.5
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
    Hit Count = 16620543263  Miss Count = 845790
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 4867; Dirty Kickouts = 0; Transfers = 845790
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 6262666441  Miss Count = 576950556
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 568537628; Dirty Kickouts = 234411130; Transfers = 580300116
    Flush Kickouts  =  3349560

Memory Level: L2
    Hit Count = 525604463  Miss Count = 289952573
    Total Requests = 815557036
    Hit Rate = 64.4%   Miss Rate = 35.6%
    Kickouts = 257143299; Dirty Kickouts = 118855612; Transfers = 305468377
    Flush Kickouts  =  15515804

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $100;   Memory Cost = $75   Total Cost = $975
Flushes = 32862 : Invalidates = 32862
```

```
------------------------------------------------------------------
              omnetpp.All-2way           Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 2 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 81373982925; Total References = 10000000076
Flush Time = 655892661
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
    Reads  =     2011922989    [20.1%]
    Writes =     1239405364    [12.4%]
    Inst.  =     6748671723    [67.5%]
    Total  =     10000000076

Total cycles for activities: [Percentage]
    Reads  =     36766994360    [45.2%]
    Writes =     8301079521    [10.2%]
    Inst.  =     36305909044    [44.6%]
    Total  =     81373982925

Average cycles for activities:
  Read =  18.3; Write =  6.7; Inst. =  12.1
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
    Hit Count = 11118333347  Miss Count = 341151726
    Total Requests = 11459485073
    Hit Rate = 97.0%   Miss Rate = 3.0%
    Kickouts = 336631094; Dirty Kickouts = 0; Transfers = 341151726
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 5675568402  Miss Count = 262045382
    Total Requests = 5937613784
    Hit Rate = 95.6%   Miss Rate = 4.4%
    Kickouts = 257498822; Dirty Kickouts = 104790863; Transfers = 264066286
    Flush Kickouts  =  2020904

Memory Level: L2
    Hit Count = 453912430  Miss Count = 256096445
    Total Requests = 710008875
    Hit Rate = 63.9%   Miss Rate = 36.1%
    Kickouts = 247005885; Dirty Kickouts = 58841113; Transfers = 259476879
    Flush Kickouts  =  3380434

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $100;   Memory Cost = $75   Total Cost = $975
Flushes = 17759 : Invalidates = 17759
```

```
----------------------------------------------------------------------
              omnetpp.All-4way           Simulation Results
----------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 4 : block size = 32
    Icache Size = 8192 : ways = 4 : block size = 32
    L2-cache Size = 32768 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 69637722545; Total References = 10000000076
Flush Time = 646260561
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
    Reads  =     2011922989    [20.1%]
    Writes =     1239405364    [12.4%]
    Inst.  =     6748671723    [67.5%]
    Total  =     10000000076

Total cycles for activities: [Percentage]
    Reads  =     31988071793    [45.9%]
    Writes =     7499972380    [10.8%]
    Inst.  =     30149678372    [43.3%]
    Total  =     69637722545

Average cycles for activities:
  Read =  15.9; Write =  6.1; Inst. =  10.3
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
    Hit Count = 11172241478  Miss Count = 287243595
    Total Requests = 11459485073
    Hit Rate = 97.5%   Miss Rate = 2.5%
    Kickouts = 282697388; Dirty Kickouts = 0; Transfers = 287243595
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 5716738958  Miss Count = 220874826
    Total Requests = 5937613784
    Hit Rate = 96.3%   Miss Rate = 3.7%
    Kickouts = 216328266; Dirty Kickouts = 84698427; Transfers = 222939467
    Flush Kickouts  =  2064641

Memory Level: L2
    Hit Count = 388758533  Miss Count = 206122956
    Total Requests = 594881489
    Hit Rate = 65.4%   Miss Rate = 34.6%
    Kickouts = 197029856; Dirty Kickouts = 49081190; Transfers = 209458949
    Flush Kickouts  =  3335993

L1 cache cost (Icache $600) + (Dcache $600) = $1200
L2 cache cost = $150;   Memory Cost = $75   Total Cost = $1425
Flushes = 17759 : Invalidates = 17759
```

```
----------------------------------------------------------------------
              omnetpp.All-FA-L2Big       Simulation Results
----------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 256 : block size = 32
    Icache Size = 8192 : ways = 256 : block size = 32
    L2-cache Size = 65536 : ways = 1024 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 46942675291; Total References = 10000000076
Flush Time = 1089922457
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
    Reads  =     2011922989    [20.1%]
    Writes =     1239405364    [12.4%]
    Inst.  =     6748671723    [67.5%]
    Total  =     10000000076

Total cycles for activities: [Percentage]
    Reads  =     21244617150    [45.3%]
    Writes =     5910130216    [12.6%]
    Inst.  =     19787927925    [42.2%]
    Total  =     46942675291

Average cycles for activities:
  Read =  10.6; Write =  4.8; Inst. =  7.0
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
    Hit Count = 11255563338  Miss Count = 203921735
    Total Requests = 11459485073
    Hit Rate = 98.2%   Miss Rate = 1.8%
    Kickouts = 199375350; Dirty Kickouts = 0; Transfers = 203921735
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 5758964173  Miss Count = 178649611
    Total Requests = 5937613784
    Hit Rate = 97.0%   Miss Rate = 3.0%
    Kickouts = 174103051; Dirty Kickouts = 71366416; Transfers = 180733918
    Flush Kickouts  =  2084307

Memory Level: L2
    Hit Count = 354074690  Miss Count = 101947379
    Total Requests = 456022069
    Hit Rate = 77.6%   Miss Rate = 22.4%
    Kickouts = 83761139; Dirty Kickouts = 26698111; Transfers = 108358404
    Flush Kickouts  =  6411025

L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
L2 cache cost = $1100;   Memory Cost = $75   Total Cost = $4775
Flushes = 17759 : Invalidates = 17759
```

```
----------------------------------------------------------------------
        omnetpp.All-FA       Simulation Results
----------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 256 : block size = 32
    Icache Size = 8192 : ways = 256 : block size = 32
    L2-cache Size = 32768 : ways = 512 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 59984360426; Total References = 10000000076
Flush Time = 636602282
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
    Reads  =     2011922989    [20.1%]
    Writes =     1239405364    [12.4%]
    Inst.  =     6748671723    [67.5%]
    Total  =     10000000076

Total cycles for activities: [Percentage]
    Reads  =     27380847345    [45.6%]
    Writes =     6955833533    [11.6%]
    Inst.  =     25647679548    [42.8%]
    Total  =     59984360426

Average cycles for activities:
  Read =  13.6; Write =  5.6; Inst. =  8.9
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
    Hit Count = 11255563338  Miss Count = 203921735
    Total Requests = 11459485073
    Hit Rate = 98.2%   Miss Rate = 1.8%
    Kickouts = 199375350; Dirty Kickouts = 0; Transfers = 203921735
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 5758964173  Miss Count = 178649611
    Total Requests = 5937613784
    Hit Rate = 97.0%   Miss Rate = 3.0%
    Kickouts = 174103051; Dirty Kickouts = 71366416; Transfers = 180733918
    Flush Kickouts  =  2084307

Memory Level: L2
    Hit Count = 288309065  Miss Count = 167713004
    Total Requests = 456022069
    Hit Rate = 63.2%   Miss Rate = 36.8%
    Kickouts = 158619884; Dirty Kickouts = 42647003; Transfers = 171042798
    Flush Kickouts  =  3329794

L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
L2 cache cost = $500;   Memory Cost = $75   Total Cost = $4175
Flushes = 17759 : Invalidates = 17759
```

```
----------------------------------------------------------------------
              omnetpp.default            Simulation Results
----------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 1 : block size = 32
    Icache Size = 8192 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 104543232165; Total References = 10000000076
Flush Time = 660527588
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
    Reads  =     2011922989    [20.1%]
    Writes =     1239405364    [12.4%]
    Inst.  =     6748671723    [67.5%]
    Total  =     10000000076

Total cycles for activities: [Percentage]
    Reads  =     48347587579    [46.2%]
    Writes =     10805872313    [10.3%]
    Inst.  =     45389772273    [43.4%]
    Total  =     104543232165

Average cycles for activities:
  Read =  24.0; Write =  8.7; Inst. =  15.5
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
    Hit Count = 11001025667  Miss Count = 458459406
    Total Requests = 11459485073
    Hit Rate = 96.0%   Miss Rate = 4.0%
    Kickouts = 454141835; Dirty Kickouts = 0; Transfers = 458459406
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 5568475800  Miss Count = 369137984
    Total Requests = 5937613784
    Hit Rate = 93.8%   Miss Rate = 6.2%
    Kickouts = 364591485; Dirty Kickouts = 161396759; Transfers = 371088273
    Flush Kickouts  =  1950289

Memory Level: L2
    Hit Count = 644430394  Miss Count = 346514044
    Total Requests = 990944438
    Hit Rate = 65.0%   Miss Rate = 35.0%
    Kickouts = 337480106; Dirty Kickouts = 81547212; Transfers = 349882607
    Flush Kickouts  =  3368563

L1 cache cost (Icache $200) + (Dcache $200) = $400
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $525
Flushes = 17759 : Invalidates = 17759
```

```
------------------------------------------------------------------
              omnetpp.L1-2way           Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 88775303993; Total References = 10000000076
Flush Time = 699814652
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
    Reads  =     2011922989    [20.1%]
    Writes =     1239405364    [12.4%]
    Inst.  =     6748671723    [67.5%]
    Total  =     10000000076

Total cycles for activities: [Percentage]
    Reads  =     40359663239    [45.5%]
    Writes =     9005917721    [10.1%]
    Inst.  =     39409723033    [44.4%]
    Total  =     88775303993

Average cycles for activities:
  Read =  20.1; Write =  7.3; Inst. =  13.2
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
    Hit Count = 11118333347  Miss Count = 341151726
    Total Requests = 11459485073
    Hit Rate = 97.0%   Miss Rate = 3.0%
    Kickouts = 336631094; Dirty Kickouts = 0; Transfers = 341151726
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 5675568402  Miss Count = 262045382
    Total Requests = 5937613784
    Hit Rate = 95.6%   Miss Rate = 4.4%
    Kickouts = 257498822; Dirty Kickouts = 104790863; Transfers = 264066286
    Flush Kickouts  =  2020904

Memory Level: L2
    Hit Count = 415208666  Miss Count = 294800209
    Total Requests = 710008875
    Hit Rate = 58.5%   Miss Rate = 41.5%
    Kickouts = 285766278; Dirty Kickouts = 64669117; Transfers = 298213842
    Flush Kickouts  =  3413633

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $925
Flushes = 17759 : Invalidates = 17759
```

```
------------------------------------------------------------------
              omnetpp.L1-8way           Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 8 : block size = 32
    Icache Size = 8192 : ways = 8 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 75262800038; Total References = 10000000076
Flush Time = 741988667
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
    Reads  =     2011922989    [20.1%]
    Writes =     1239405364    [12.4%]
    Inst.  =     6748671723    [67.5%]
    Total  =     10000000076

Total cycles for activities: [Percentage]
    Reads  =     33335550580    [44.3%]
    Writes =     8004600769    [10.6%]
    Inst.  =     33922648689    [45.1%]
    Total  =     75262800038

Average cycles for activities:
  Read =  16.6; Write =  6.5; Inst. =  11.2
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
    Hit Count = 11196786235  Miss Count = 262698838
    Total Requests = 11459485073
    Hit Rate = 97.7%   Miss Rate = 2.3%
    Kickouts = 258152461; Dirty Kickouts = 0; Transfers = 262698838
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 5740720184  Miss Count = 196893600
    Total Requests = 5937613784
    Hit Rate = 96.7%   Miss Rate = 3.3%
    Kickouts = 192347040; Dirty Kickouts = 76592811; Transfers = 198969396
    Flush Kickouts  =  2075796

Memory Level: L2
    Hit Count = 295795041  Miss Count = 242466004
    Total Requests = 538261045
    Hit Rate = 55.0%   Miss Rate = 45.0%
    Kickouts = 233432073; Dirty Kickouts = 51782118; Transfers = 245936201
    Flush Kickouts  =  3470197

L1 cache cost (Icache $800) + (Dcache $800) = $1600
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $1725
Flushes = 17759 : Invalidates = 17759
```

```
------------------------------------------------------------------
              omnetpp.L1-small-4way            Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 4096 : ways = 4 : block size = 32
    Icache Size = 4096 : ways = 4 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 112049323064; Total References = 10000000076
Flush Time = 527424836
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
    Reads  =     2011922989    [20.1%]
    Writes =     1239405364    [12.4%]
    Inst.  =     6748671723    [67.5%]
    Total  =     10000000076

Total cycles for activities: [Percentage]
    Reads  =     47375952557    [42.3%]
    Writes =     9481535713    [8.5%]
    Inst.  =     55191834794    [49.3%]
    Total  =     112049323064

Average cycles for activities:
  Read =  23.5; Write =  7.7; Inst. =  16.6
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
    Hit Count = 10797463020  Miss Count = 662022053
    Total Requests = 11459485073
    Hit Rate = 94.2%   Miss Rate = 5.8%
    Kickouts = 659748821; Dirty Kickouts = 0; Transfers = 662022053
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 5577120317  Miss Count = 360493467
    Total Requests = 5937613784
    Hit Rate = 93.9%   Miss Rate = 6.1%
    Kickouts = 358220187; Dirty Kickouts = 138937083; Transfers = 361558962
    Flush Kickouts  =  1065495

Memory Level: L2
    Hit Count = 780952027  Miss Count = 381566071
    Total Requests = 1162518098
    Hit Rate = 67.2%   Miss Rate = 32.8%
    Kickouts = 372532140; Dirty Kickouts = 75051411; Transfers = 384454681
    Flush Kickouts  =  2888610

L1 cache cost (Icache $300) + (Dcache $300) = $600
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $725
Flushes = 17759 : Invalidates = 17759
```

```
------------------------------------------------------------------
              omnetpp.L1-small           Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 4096 : ways = 1 : block size = 32
    Icache Size = 4096 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 122133399253; Total References = 10000000076
Flush Time = 507087929
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
    Reads  =     2011922989    [20.1%]
    Writes =     1239405364    [12.4%]
    Inst.  =     6748671723    [67.5%]
    Total  =     10000000076

Total cycles for activities: [Percentage]
    Reads  =     54503976423    [44.6%]
    Writes =     11412022335    [9.3%]
    Inst.  =     56217400495    [46.0%]
    Total  =     122133399253

Average cycles for activities:
  Read =  27.1; Write =  9.2; Inst. =  18.1
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
    Hit Count = 10787606038  Miss Count = 671879035
    Total Requests = 11459485073
    Hit Rate = 94.1%   Miss Rate = 5.9%
    Kickouts = 669605955; Dirty Kickouts = 0; Transfers = 671879035
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 5431113100  Miss Count = 506500684
    Total Requests = 5937613784
    Hit Rate = 91.5%   Miss Rate = 8.5%
    Kickouts = 504227404; Dirty Kickouts = 216081736; Transfers = 507492305
    Flush Kickouts  =  991621

Memory Level: L2
    Hit Count = 989572725  Miss Count = 405880351
    Total Requests = 1395453076
    Hit Rate = 70.9%   Miss Rate = 29.1%
    Kickouts = 396846420; Dirty Kickouts = 89897303; Transfers = 408758710
    Flush Kickouts  =  2878359

L1 cache cost (Icache $100) + (Dcache $100) = $200
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $325
Flushes = 17759 : Invalidates = 17759
```

```
----------------------------------------------------------------------
              omnetpp.L2-4way           Simulation Results
----------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 74513693971; Total References = 10000000076
Flush Time = 617942136
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
    Reads  =     2011922989    [20.1%]
    Writes =     1239405364    [12.4%]
    Inst.  =     6748671723    [67.5%]
    Total  =     10000000076

Total cycles for activities: [Percentage]
    Reads  =     33604571151    [45.1%]
    Writes =     7889046837    [10.6%]
    Inst.  =     33020075983    [44.3%]
    Total  =     74513693971

Average cycles for activities:
  Read =  16.7; Write =  6.4; Inst. =  11.0
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
    Hit Count = 11118333347  Miss Count = 341151726
    Total Requests = 11459485073
    Hit Rate = 97.0%   Miss Rate = 3.0%
    Kickouts = 336631094; Dirty Kickouts = 0; Transfers = 341151726
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 5675568402  Miss Count = 262045382
    Total Requests = 5937613784
    Hit Rate = 95.6%   Miss Rate = 4.4%
    Kickouts = 257498822; Dirty Kickouts = 104790863; Transfers = 264066286
    Flush Kickouts  =  2020904

Memory Level: L2
    Hit Count = 488961412  Miss Count = 221047463
    Total Requests = 710008875
    Hit Rate = 68.9%   Miss Rate = 31.1%
    Kickouts = 211954363; Dirty Kickouts = 52634438; Transfers = 224340141
    Flush Kickouts  =  3292678

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $150;   Memory Cost = $75   Total Cost = $1025
Flushes = 17759 : Invalidates = 17759
```

```
----------------------------------------------------------------------
              omnetpp.L2-Big             Simulation Results
----------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 65536 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 71996947518; Total References = 10000000076
Flush Time = 1164405171
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
    Reads  =     2011922989    [20.1%]
    Writes =     1239405364    [12.4%]
    Inst.  =     6748671723    [67.5%]
    Total  =     10000000076

Total cycles for activities: [Percentage]
    Reads  =     32030086301    [44.5%]
    Writes =     7484736031    [10.4%]
    Inst.  =     32482125186    [45.1%]
    Total  =     71996947518

Average cycles for activities:
  Read =  15.9; Write =  6.0; Inst. =  10.7
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
    Hit Count = 11118333347  Miss Count = 341151726
    Total Requests = 11459485073
    Hit Rate = 97.0%   Miss Rate = 3.0%
    Kickouts = 336631094; Dirty Kickouts = 0; Transfers = 341151726
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 5675568402  Miss Count = 262045382
    Total Requests = 5937613784
    Hit Rate = 95.6%   Miss Rate = 4.4%
    Kickouts = 257498822; Dirty Kickouts = 104790863; Transfers = 264066286
    Flush Kickouts  =  2020904

Memory Level: L2
    Hit Count = 502325991  Miss Count = 207682884
    Total Requests = 710008875
    Hit Rate = 70.7%   Miss Rate = 29.3%
    Kickouts = 191072715; Dirty Kickouts = 47529912; Transfers = 214299702
    Flush Kickouts  =  6616818

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $100;   Memory Cost = $75   Total Cost = $975
Flushes = 17759 : Invalidates = 17759
```

```
------------------------------------------------------------------
              sjeng.All-2way            Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 2 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 43738944530; Total References = 10000000109
Flush Time = 616193540
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     10477993739    [24.0%]
    Writes =     7023616800    [16.1%]
    Inst.  =     26237333991    [60.0%]
    Total  =     43738944530

Average cycles for activities:
  Read =  5.5; Write =  9.7; Inst. =  5.9
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12329298530  Miss Count = 223077262
    Total Requests = 12552375792
    Hit Rate = 98.2%   Miss Rate = 1.8%
    Kickouts = 218150210; Dirty Kickouts = 0; Transfers = 223077262
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3176318967  Miss Count = 121259542
    Total Requests = 3297578509
    Hit Rate = 96.3%   Miss Rate = 3.7%
    Kickouts = 116336783; Dirty Kickouts = 53348235; Transfers = 123531608
    Flush Kickouts  =  2272066

Memory Level: L2
    Hit Count = 296073075  Miss Count = 103884030
    Total Requests = 399957105
    Hit Rate = 74.0%   Miss Rate = 26.0%
    Kickouts = 94437719; Dirty Kickouts = 23349926; Transfers = 106763253
    Flush Kickouts  =  2879223

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $100;   Memory Cost = $75   Total Cost = $975
Flushes = 19380 : Invalidates = 19380
```

```
------------------------------------------------------------------
              sjeng.All-4way            Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 4 : block size = 32
    Icache Size = 8192 : ways = 4 : block size = 32
    L2-cache Size = 32768 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 39773639514; Total References = 10000000109
Flush Time = 622436109
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     9539682524    [24.0%]
    Writes =     6034448117    [15.2%]
    Inst.  =     24199508873    [60.8%]
    Total  =     39773639514

Average cycles for activities:
  Read =  5.0; Write =  8.3; Inst. =  5.4
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12332868797  Miss Count = 219506995
    Total Requests = 12552375792
    Hit Rate = 98.3%   Miss Rate = 1.7%
    Kickouts = 214571765; Dirty Kickouts = 0; Transfers = 219506995
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3200939266  Miss Count = 96639243
    Total Requests = 3297578509
    Hit Rate = 97.1%   Miss Rate = 2.9%
    Kickouts = 91680120; Dirty Kickouts = 43578332; Transfers = 99076445
    Flush Kickouts  =  2437202

Memory Level: L2
    Hit Count = 275259247  Miss Count = 86902525
    Total Requests = 362161772
    Hit Rate = 76.0%   Miss Rate = 24.0%
    Kickouts = 77135293; Dirty Kickouts = 20032069; Transfers = 89760398
    Flush Kickouts  =  2857873

L1 cache cost (Icache $600) + (Dcache $600) = $1200
L2 cache cost = $150;   Memory Cost = $75   Total Cost = $1425
Flushes = 19380 : Invalidates = 19380
```

```
--------------------------------------------------------------------
             sjeng.All-FA-L2Big         Simulation Results
--------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 256 : block size = 32
    Icache Size = 8192 : ways = 256 : block size = 32
    L2-cache Size = 65536 : ways = 1024 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 27997462644; Total References = 10000000109
Flush Time = 1138079660
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     4596772368    [16.4%]
    Writes =     4473806936    [16.0%]
    Inst.  =     18926883340    [67.6%]
    Total  =     27997462644

Average cycles for activities:
  Read =  2.4; Write =  6.1; Inst. =  3.8
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12304531662  Miss Count = 247844130
    Total Requests = 12552375792
    Hit Rate = 98.0%   Miss Rate = 2.0%
    Kickouts = 242908780; Dirty Kickouts = 0; Transfers = 247844130
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3228649349  Miss Count = 68929160
    Total Requests = 3297578509
    Hit Rate = 97.9%   Miss Rate = 2.1%
    Kickouts = 63967624; Dirty Kickouts = 35733591; Transfers = 71351092
    Flush Kickouts  =  2421932

Memory Level: L2
    Hit Count = 328808359  Miss Count = 26120454
    Total Requests = 354928813
    Hit Rate = 92.6%   Miss Rate = 7.4%
    Kickouts = 7149991; Dirty Kickouts = 6688891; Transfers = 32835857
    Flush Kickouts  =  6715403

L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
L2 cache cost = $1100;   Memory Cost = $75   Total Cost = $4775
Flushes = 19380 : Invalidates = 19380
```

```
------------------------------------------------------------------
        sjeng.All-FA       Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 256 : block size = 32
    Icache Size = 8192 : ways = 256 : block size = 32
    L2-cache Size = 32768 : ways = 512 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 33408802189; Total References = 10000000109
Flush Time = 585242533
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     7141935346    [21.4%]
    Writes =     5112141054    [15.3%]
    Inst.  =     21154725789    [63.3%]
    Total  =     33408802189

Average cycles for activities:
  Read =  3.7; Write =  7.0; Inst. =  4.5
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12304531662  Miss Count = 247844130
    Total Requests = 12552375792
    Hit Rate = 98.0%   Miss Rate = 2.0%
    Kickouts = 242908780; Dirty Kickouts = 0; Transfers = 247844130
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3228649349  Miss Count = 68929160
    Total Requests = 3297578509
    Hit Rate = 97.9%   Miss Rate = 2.1%
    Kickouts = 63967624; Dirty Kickouts = 35733591; Transfers = 71351092
    Flush Kickouts  =  2421932

Memory Level: L2
    Hit Count = 299602024  Miss Count = 55326789
    Total Requests = 354928813
    Hit Rate = 84.4%   Miss Rate = 15.6%
    Kickouts = 45404076; Dirty Kickouts = 14057553; Transfers = 58010290
    Flush Kickouts  =  2683501

L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
L2 cache cost = $500;   Memory Cost = $75   Total Cost = $4175
Flushes = 19380 : Invalidates = 19380
```

```
---------------------------------------------------------------------
              sjeng.default       Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 1 : block size = 32
    Icache Size = 8192 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 53147451742; Total References = 10000000109
Flush Time = 729751597
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     15529463104    [29.2%]
    Writes =     7799108595    [14.7%]
    Inst.  =     29818880043    [56.1%]
    Total  =     53147451742

Average cycles for activities:
  Read =  8.1; Write =  10.7; Inst. =  7.2
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12315460748  Miss Count = 236915044
    Total Requests = 12552375792
    Hit Rate = 98.1%   Miss Rate = 1.9%
    Kickouts = 232095465; Dirty Kickouts = 0; Transfers = 236915044
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3108702506  Miss Count = 188876003
    Total Requests = 3297578509
    Hit Rate = 94.3%   Miss Rate = 5.7%
    Kickouts = 184181921; Dirty Kickouts = 74706271; Transfers = 191096087
    Flush Kickouts  =  2220084

Memory Level: L2
    Hit Count = 358961550  Miss Count = 143755852
    Total Requests = 502717402
    Hit Rate = 71.4%   Miss Rate = 28.6%
    Kickouts = 134964689; Dirty Kickouts = 29811518; Transfers = 147217572
    Flush Kickouts  =  3461720

L1 cache cost (Icache $200) + (Dcache $200) = $400
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $525
Flushes = 19380 : Invalidates = 19380
```

```
---------------------------------------------------------------------
              sjeng.L1-2way       Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 47624319306; Total References = 10000000109
Flush Time = 718615404
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     12212215828    [25.6%]
    Writes =     7301114606    [15.3%]
    Inst.  =     28110988872    [59.0%]
    Total  =     47624319306

Average cycles for activities:
  Read =  6.4; Write =  10.0; Inst. =  6.5
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12329298530  Miss Count = 223077262
    Total Requests = 12552375792
    Hit Rate = 98.2%   Miss Rate = 1.8%
    Kickouts = 218150210; Dirty Kickouts = 0; Transfers = 223077262
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3176318967  Miss Count = 121259542
    Total Requests = 3297578509
    Hit Rate = 96.3%   Miss Rate = 3.7%
    Kickouts = 116336783; Dirty Kickouts = 53348235; Transfers = 123531608
    Flush Kickouts  =  2272066

Memory Level: L2
    Hit Count = 275430347  Miss Count = 124526758
    Total Requests = 399957105
    Hit Rate = 68.9%   Miss Rate = 31.1%
    Kickouts = 115773678; Dirty Kickouts = 25560107; Transfers = 127933545
    Flush Kickouts  =  3406787

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $925
Flushes = 19380 : Invalidates = 19380
```

```
------------------------------------------------------------------
              sjeng.L1-8way       Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 8 : block size = 32
    Icache Size = 8192 : ways = 8 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 43670677136; Total References = 10000000109
Flush Time = 781207070
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     9991306839    [22.9%]
    Writes =     6342049093    [14.5%]
    Inst.  =     27337321204    [62.6%]
    Total  =     43670677136

Average cycles for activities:
  Read =  5.2; Write =  8.7; Inst. =  5.9
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12325674941  Miss Count = 226700851
    Total Requests = 12552375792
    Hit Rate = 98.2%   Miss Rate = 1.8%
    Kickouts = 221765528; Dirty Kickouts = 0; Transfers = 226700851
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3215035005  Miss Count = 82543504
    Total Requests = 3297578509
    Hit Rate = 97.5%   Miss Rate = 2.5%
    Kickouts = 77582058; Dirty Kickouts = 38144847; Transfers = 85027308
    Flush Kickouts  =  2483804

Memory Level: L2
    Hit Count = 239720796  Miss Count = 110152210
    Total Requests = 349873006
    Hit Rate = 68.5%   Miss Rate = 31.5%
    Kickouts = 101402078; Dirty Kickouts = 20836190; Transfers = 113490797
    Flush Kickouts  =  3338587

L1 cache cost (Icache $800) + (Dcache $800) = $1600
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $1725
Flushes = 19380 : Invalidates = 19380
```

```
------------------------------------------------------------------
              sjeng.L1-small-4way        Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 4096 : ways = 4 : block size = 32
    Icache Size = 4096 : ways = 4 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 57721016788; Total References = 10000000109
Flush Time = 537932693
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     16588370442    [28.7%]
    Writes =     7373847033    [12.8%]
    Inst.  =     33758799313    [58.5%]
    Total  =     57721016788

Average cycles for activities:
  Read =  8.7; Write =  10.1; Inst. =  7.8
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12210515336  Miss Count = 341860456
    Total Requests = 12552375792
    Hit Rate = 97.3%   Miss Rate = 2.7%
    Kickouts = 339392562; Dirty Kickouts = 0; Transfers = 341860456
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3121957304  Miss Count = 175621205
    Total Requests = 3297578509
    Hit Rate = 94.7%   Miss Rate = 5.3%
    Kickouts = 173140439; Dirty Kickouts = 69680495; Transfers = 176771793
    Flush Kickouts  =  1150588

Memory Level: L2
    Hit Count = 425937626  Miss Count = 162375118
    Total Requests = 588312744
    Hit Rate = 72.4%   Miss Rate = 27.6%
    Kickouts = 153624987; Dirty Kickouts = 30855548; Transfers = 165346101
    Flush Kickouts  =  2970983

L1 cache cost (Icache $300) + (Dcache $300) = $600
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $725
Flushes = 19380 : Invalidates = 19380
```

```
------------------------------------------------------------------
              sjeng.L1-small            Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 4096 : ways = 1 : block size = 32
    Icache Size = 4096 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 64063737148; Total References = 10000000109
Flush Time = 521638395
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     20529757060    [32.0%]
    Writes =     8411003730    [13.1%]
    Inst.  =     35122976358    [54.8%]
    Total  =     64063737148

Average cycles for activities:
  Read =  10.8; Write =  11.6; Inst. =  8.7
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12184655643  Miss Count = 367720149
    Total Requests = 12552375792
    Hit Rate = 97.1%   Miss Rate = 2.9%
    Kickouts = 365252531; Dirty Kickouts = 0; Transfers = 367720149
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2973403604  Miss Count = 324174905
    Total Requests = 3297578509
    Hit Rate = 90.2%   Miss Rate = 9.8%
    Kickouts = 321698344; Dirty Kickouts = 121570257; Transfers = 325180672
    Flush Kickouts  =  1005767

Memory Level: L2
    Hit Count = 639175349  Miss Count = 175295729
    Total Requests = 814471078
    Hit Rate = 78.5%   Miss Rate = 21.5%
    Kickouts = 166544911; Dirty Kickouts = 34738816; Transfers = 178247131
    Flush Kickouts  =  2951402

L1 cache cost (Icache $100) + (Dcache $100) = $200
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $325
Flushes = 19380 : Invalidates = 19380
```

```
------------------------------------------------------------------
              sjeng.L2-4way       Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 32768 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 40655098778; Total References = 10000000109
Flush Time = 596154786
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     9790459257    [24.1%]
    Writes =     6315919825    [15.5%]
    Inst.  =     24548719696    [60.4%]
    Total  =     40655098778

Average cycles for activities:
  Read =  5.1; Write =  8.7; Inst. =  5.5
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12329298530  Miss Count = 223077262
    Total Requests = 12552375792
    Hit Rate = 98.2%   Miss Rate = 1.8%
    Kickouts = 218150210; Dirty Kickouts = 0; Transfers = 223077262
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3176318967  Miss Count = 121259542
    Total Requests = 3297578509
    Hit Rate = 96.3%   Miss Rate = 3.7%
    Kickouts = 116336783; Dirty Kickouts = 53348235; Transfers = 123531608
    Flush Kickouts  =  2272066

Memory Level: L2
    Hit Count = 311879131  Miss Count = 88077974
    Total Requests = 399957105
    Hit Rate = 78.0%   Miss Rate = 22.0%
    Kickouts = 78309288; Dirty Kickouts = 20598245; Transfers = 90932413
    Flush Kickouts  =  2854439

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $150;   Memory Cost = $75   Total Cost = $1025
Flushes = 19380 : Invalidates = 19380
```

```
------------------------------------------------------------------
              sjeng.L2-Big        Simulation Results
------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 2 : block size = 32
    Icache Size = 8192 : ways = 2 : block size = 32
    L2-cache Size = 65536 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 39092447074; Total References = 10000000109
Flush Time = 1463318135
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     9162625352    [23.4%]
    Writes =     5899887603    [15.1%]
    Inst.  =     24029934119    [61.5%]
    Total  =     39092447074

Average cycles for activities:
  Read =  4.8; Write =  8.1; Inst. =  5.3
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12329298530  Miss Count = 223077262
    Total Requests = 12552375792
    Hit Rate = 98.2%   Miss Rate = 1.8%
    Kickouts = 218150210; Dirty Kickouts = 0; Transfers = 223077262
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3176318967  Miss Count = 121259542
    Total Requests = 3297578509
    Hit Rate = 96.3%   Miss Rate = 3.7%
    Kickouts = 116336783; Dirty Kickouts = 53348235; Transfers = 123531608
    Flush Kickouts  =  2272066

Memory Level: L2
    Hit Count = 322591523  Miss Count = 77365582
    Total Requests = 399957105
    Hit Rate = 80.7%   Miss Rate = 19.3%
    Kickouts = 64457727; Dirty Kickouts = 16390308; Transfers = 85842444
    Flush Kickouts  =  8476862

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $100;   Memory Cost = $75   Total Cost = $975
Flushes = 19380 : Invalidates = 19380
```

```
---------------------------------------------------------------------
          sjeng.mem_config16              Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 1 : block size = 32
    Icache Size = 8192 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 16 : chunktime = 15

Execute Time = 42525706342; Total References = 10000000109
Flush Time = 470634817
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     11763620944    [27.7%]
    Writes =     5802400395    [13.6%]
    Inst.  =     24959685003    [58.7%]
    Total  =     42525706342

Average cycles for activities:
  Read =  6.2; Write =  8.0; Inst. =  5.8
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12315460748  Miss Count = 236915044
    Total Requests = 12552375792
    Hit Rate = 98.1%   Miss Rate = 1.9%
    Kickouts = 232095465; Dirty Kickouts = 0; Transfers = 236915044
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3108702506  Miss Count = 188876003
    Total Requests = 3297578509
    Hit Rate = 94.3%   Miss Rate = 5.7%
    Kickouts = 184181921; Dirty Kickouts = 74706271; Transfers = 191096087
    Flush Kickouts  =  2220084

Memory Level: L2
    Hit Count = 358961550  Miss Count = 143755852
    Total Requests = 502717402
    Hit Rate = 71.4%   Miss Rate = 28.6%
    Kickouts = 134964689; Dirty Kickouts = 29811518; Transfers = 147217572
    Flush Kickouts  =  3461720

L1 cache cost (Icache $200) + (Dcache $200) = $400
L2 cache cost = $50;   Memory Cost = $175   Total Cost = $625
Flushes = 19380 : Invalidates = 19380
```

```
---------------------------------------------------------------------
          sjeng.mem_config32              Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 1 : block size = 32
    Icache Size = 8192 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 32 : chunktime = 15

Execute Time = 37214833642; Total References = 10000000109
Flush Time = 341076427
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     9880699864    [26.6%]
    Writes =     4804046295    [12.9%]
    Inst.  =     22530087483    [60.5%]
    Total  =     37214833642

Average cycles for activities:
  Read =  5.2; Write =  6.6; Inst. =  5.1
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12315460748  Miss Count = 236915044
    Total Requests = 12552375792
    Hit Rate = 98.1%   Miss Rate = 1.9%
    Kickouts = 232095465; Dirty Kickouts = 0; Transfers = 236915044
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3108702506  Miss Count = 188876003
    Total Requests = 3297578509
    Hit Rate = 94.3%   Miss Rate = 5.7%
    Kickouts = 184181921; Dirty Kickouts = 74706271; Transfers = 191096087
    Flush Kickouts  =  2220084

Memory Level: L2
    Hit Count = 358961550  Miss Count = 143755852
    Total Requests = 502717402
    Hit Rate = 71.4%   Miss Rate = 28.6%
    Kickouts = 134964689; Dirty Kickouts = 29811518; Transfers = 147217572
    Flush Kickouts  =  3461720

L1 cache cost (Icache $200) + (Dcache $200) = $400
L2 cache cost = $50;   Memory Cost = $275   Total Cost = $725
Flushes = 19380 : Invalidates = 19380
```

```
--------------------------------------------------------------------
          sjeng.mem_config64              Simulation Results
--------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 1 : block size = 32
    Icache Size = 8192 : ways = 1 : block size = 32
    L2-cache Size = 32768 : ways = 1 : block size = 64
    Memory ready time = 30 : chunksize = 64 : chunktime = 15

Execute Time = 34559397292; Total References = 10000000109
Flush Time = 276297232
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     8939239324    [25.9%]
    Writes =     4304869245    [12.5%]
    Inst.  =     21315288723    [61.7%]
    Total  =     34559397292

Average cycles for activities:
  Read =  4.7; Write =  5.9; Inst. =  4.7
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12315460748  Miss Count = 236915044
    Total Requests = 12552375792
    Hit Rate = 98.1%   Miss Rate = 1.9%
    Kickouts = 232095465; Dirty Kickouts = 0; Transfers = 236915044
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3108702506  Miss Count = 188876003
    Total Requests = 3297578509
    Hit Rate = 94.3%   Miss Rate = 5.7%
    Kickouts = 184181921; Dirty Kickouts = 74706271; Transfers = 191096087
    Flush Kickouts  =  2220084

Memory Level: L2
    Hit Count = 358961550  Miss Count = 143755852
    Total Requests = 502717402
    Hit Rate = 71.4%   Miss Rate = 28.6%
    Kickouts = 134964689; Dirty Kickouts = 29811518; Transfers = 147217572
    Flush Kickouts  =  3461720

L1 cache cost (Icache $200) + (Dcache $200) = $400
L2 cache cost = $50;   Memory Cost = $375   Total Cost = $825
Flushes = 19380 : Invalidates = 19380
```

```
---------------------------------------------------------------------
             bzip2.custom-L2-Big-All4way             Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 4 : block size = 32
    Icache Size = 8192 : ways = 4 : block size = 32
    L2-cache Size = 65536 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 48216790208; Total References = 10000000073
Flush Time = 723087476
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
    Reads  =     1882275327    [18.8%]
    Writes =     552506959    [5.5%]
    Inst.  =     7565217787    [75.7%]
    Total  =     10000000073

Total cycles for activities: [Percentage]
    Reads  =     18298910235    [38.0%]
    Writes =     17036204390    [35.3%]
    Inst.  =     12881675583    [26.7%]
    Total  =     48216790208

Average cycles for activities:
  Read =  9.7; Write =  30.8; Inst. =  6.4
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
    Hit Count = 12095527306  Miss Count = 555216
    Total Requests = 12096082522
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 1778; Dirty Kickouts = 0; Transfers = 555216
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 2380037622  Miss Count = 158162774
    Total Requests = 2538200396
    Hit Rate = 93.8%   Miss Rate = 6.2%
    Kickouts = 153066463; Dirty Kickouts = 61597513; Transfers = 159395257
    Flush Kickouts  =  1232483

Memory Level: L2
    Hit Count = 94575336  Miss Count = 126972650
    Total Requests = 221547986
    Hit Rate = 42.7%   Miss Rate = 57.3%
    Kickouts = 108181098; Dirty Kickouts = 51264574; Transfers = 131308932
    Flush Kickouts  =  4336282

L1 cache cost (Icache $600) + (Dcache $600) = $1200
L2 cache cost = $300;   Memory Cost = $75   Total Cost = $1575
Flushes = 19908 : Invalidates = 19908
```

```
---------------------------------------------------------------------
             h264ref.custom-L2-Big-All4way           Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 4 : block size = 32
    Icache Size = 8192 : ways = 4 : block size = 32
    L2-cache Size = 65536 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 23284345682; Total References = 10000000106
Flush Time = 893943639
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
    Reads  =     2689845793    [26.9%]
    Writes =     580065162    [5.8%]
    Inst.  =     6730089151    [67.3%]
    Total  =     10000000106

Total cycles for activities: [Percentage]
    Reads  =     7290457370    [31.3%]
    Writes =     2146559779    [9.2%]
    Inst.  =     13847328533    [59.5%]
    Total  =     23284345682

Average cycles for activities:
  Read =  2.7; Write =  3.7; Inst. =  3.5
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
    Hit Count = 11159355699  Miss Count = 48721189
    Total Requests = 11208076888
    Hit Rate = 99.6%   Miss Rate = 0.4%
    Kickouts = 45599000; Dirty Kickouts = 0; Transfers = 48721189
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3962032699  Miss Count = 62702627
    Total Requests = 4024735326
    Hit Rate = 98.4%   Miss Rate = 1.6%
    Kickouts = 58175096; Dirty Kickouts = 15514970; Transfers = 64163345
    Flush Kickouts  =  1460718

Memory Level: L2
    Hit Count = 100186708  Miss Count = 28212796
    Total Requests = 128399504
    Hit Rate = 78.0%   Miss Rate = 22.0%
    Kickouts = 14377967; Dirty Kickouts = 2745701; Transfers = 33608221
    Flush Kickouts  =  5395425

L1 cache cost (Icache $600) + (Dcache $600) = $1200
L2 cache cost = $300;   Memory Cost = $75   Total Cost = $1575
Flushes = 17710 : Invalidates = 17710
```

```
---------------------------------------------------------------------
              libquantum.custom-L2-Big-All4way        Simulation Results
---------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 4 : block size = 32
    Icache Size = 8192 : ways = 4 : block size = 32
    L2-cache Size = 65536 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 106052900578; Total References = 16506492546
Flush Time = 2486646177
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
    Reads  =     3526260463    [21.4%]
    Writes =     492653573    [3.0%]
    Inst.  =     12487578510    [75.7%]
    Total  =     16506492546

Total cycles for activities: [Percentage]
    Reads  =     85622225337    [80.7%]
    Writes =     1184292110    [1.1%]
    Inst.  =     19246383131    [18.1%]
    Total  =     106052900578

Average cycles for activities:
  Read =  24.3; Write =  2.4; Inst. =  8.5
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
    Hit Count = 16620543782  Miss Count = 845271
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate = 0.0%
    Kickouts = 2622; Dirty Kickouts = 0; Transfers = 845271
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 6262710581  Miss Count = 576906416
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 568493488; Dirty Kickouts = 234391405; Transfers = 580255616
    Flush Kickouts  =  3349200

Memory Level: L2
    Hit Count = 526065129  Miss Count = 289427163
    Total Requests = 815492292
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 256472235; Dirty Kickouts = 118822885; Transfers = 304650667
    Flush Kickouts  =  15223504

L1 cache cost (Icache $600) + (Dcache $600) = $1200
L2 cache cost = $300;   Memory Cost = $75   Total Cost = $1575
Flushes = 32862 : Invalidates = 32862
```

```
----------------------------------------------------------------------
              omnetpp.custom-L2-Big-All4way           Simulation Results
----------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 4 : block size = 32
    Icache Size = 8192 : ways = 4 : block size = 32
    L2-cache Size = 65536 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 52079560790; Total References = 10000000076
Flush Time = 1088261835
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
    Reads  =     2011922989    [20.1%]
    Writes =     1239405364    [12.4%]
    Inst.  =     6748671723    [67.5%]
    Total  =     10000000076

Total cycles for activities: [Percentage]
    Reads  =     23278201083    [44.7%]
    Writes =     6010806866    [11.5%]
    Inst.  =     22790552841    [43.8%]
    Total  =     52079560790

Average cycles for activities:
  Read =  11.6; Write =  4.8; Inst. =  7.7
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
    Hit Count = 11172241478  Miss Count = 287243595
    Total Requests = 11459485073
    Hit Rate = 97.5%   Miss Rate = 2.5%
    Kickouts = 282697388; Dirty Kickouts = 0; Transfers = 287243595
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 5716738958  Miss Count = 220874826
    Total Requests = 5937613784
    Hit Rate = 96.3%   Miss Rate = 3.7%
    Kickouts = 216328266; Dirty Kickouts = 84698427; Transfers = 222939467
    Flush Kickouts  =  2064641

Memory Level: L2
    Hit Count = 477597458  Miss Count = 117284031
    Total Requests = 594881489
    Hit Rate = 80.3%   Miss Rate = 19.7%
    Kickouts = 99189969; Dirty Kickouts = 28996565; Transfers = 123691766
    Flush Kickouts  =  6407735

L1 cache cost (Icache $600) + (Dcache $600) = $1200
L2 cache cost = $300;   Memory Cost = $75   Total Cost = $1575
Flushes = 17759 : Invalidates = 17759
```

```
--------------------------------------------------------------------
             sjeng.custom-L2-Big-All4way             Simulation Results
--------------------------------------------------------------------

Memory System:
    Dcache Size = 8192 : ways = 4 : block size = 32
    Icache Size = 8192 : ways = 4 : block size = 32
    L2-cache Size = 65536 : ways = 4 : block size = 64
    Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 30613648029; Total References = 10000000109
Flush Time = 977701764
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
    Reads  =     1907768017    [19.1%]
    Writes =     727693598    [7.3%]
    Inst.  =     7364538494    [73.6%]
    Total  =     10000000109

Total cycles for activities: [Percentage]
    Reads  =     6113817379    [20.0%]
    Writes =     5191002518    [17.0%]
    Inst.  =     19308828132    [63.1%]
    Total  =     30613648029

Average cycles for activities:
  Read =  3.2; Write =  7.1; Inst. =  4.2
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
    Hit Count = 12332868797  Miss Count = 219506995
    Total Requests = 12552375792
    Hit Rate = 98.3%   Miss Rate = 1.7%
    Kickouts = 214571765; Dirty Kickouts = 0; Transfers = 219506995
    Flush Kickouts  =  0

Memory Level: L1d
    Hit Count = 3200939266  Miss Count = 96639243
    Total Requests = 3297578509
    Hit Rate = 97.1%   Miss Rate = 2.9%
    Kickouts = 91680120; Dirty Kickouts = 43578332; Transfers = 99076445
    Flush Kickouts  =  2437202

Memory Level: L2
    Hit Count = 324341002  Miss Count = 37820770
    Total Requests = 362161772
    Hit Rate = 89.6%   Miss Rate = 10.4%
    Kickouts = 21862914; Dirty Kickouts = 11199018; Transfers = 43490829
    Flush Kickouts  =  5670059

L1 cache cost (Icache $600) + (Dcache $600) = $1200
L2 cache cost = $300;   Memory Cost = $75   Total Cost = $1575
Flushes = 19380 : Invalidates = 19380
```

```
---------------------------------------------------------------------
        bzip2.custom-L1-big        Simulation Results
---------------------------------------------------------------------

Memory System:
       Dcache Size = 16384 : ways = 1 : block size = 32
       Icache Size = 16384 : ways = 1 : block size = 32
       L2-cache Size = 32768 : ways = 1 : block size = 64
       Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 54429359623; Total References = 10000000073
Flush Time = 619864597
Inst refs = 7565217787; Data refs = 2434782286

Number of references types: [Percentage]
       Reads  =     1882275327    [18.8%]
       Writes =     552506959    [5.5%]
       Inst.  =     7565217787    [75.7%]
       Total  =     10000000073

Total cycles for activities: [Percentage]
       Reads  =     22264211570   [40.9%]
       Writes =     19384958922   [35.6%]
       Inst.  =     12780189131   [23.5%]
       Total  =     54429359623

Average cycles for activities:
  Read =  11.8; Write =  35.1; Inst. =  7.2
Ideal: Exec. Time = 17565217860; CPI =  2.3
Ideal mis-aligned: Exec. Time = 22199500705; CPI = 2.9

Memory Level: L1i
       Hit Count = 12095524687  Miss Count = 557835
       Total Requests = 12096082522
       Hit Rate = 100.0%   Miss Rate = 0.0%
       Kickouts = 6465; Dirty Kickouts = 0; Transfers = 557835
       Flush Kickouts  =  0

Memory Level: L1d
       Hit Count = 2372793489  Miss Count = 165406907
       Total Requests = 2538200396
       Hit Rate = 93.5%   Miss Rate = 6.5%
       Kickouts = 155523964; Dirty Kickouts = 63980822; Transfers = 167796750
       Flush Kickouts  =  2389843

Memory Level: L2
       Hit Count = 74234073  Miss Count = 158101334
       Total Requests = 232335407
       Hit Rate = 32.0%   Miss Rate = 68.0%
       Kickouts = 148387546; Dirty Kickouts = 58444848; Transfers = 160538724
       Flush Kickouts  =  2437390

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $925
Flushes = 19908 : Invalidates = 19908
```

```
---------------------------------------------------------------------
        h264ref.custom-L1-big      Simulation Results
---------------------------------------------------------------------

Memory System:
       Dcache Size = 16384 : ways = 1 : block size = 32
       Icache Size = 16384 : ways = 1 : block size = 32
       L2-cache Size = 32768 : ways = 1 : block size = 64
       Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 33322775869; Total References = 10000000106
Flush Time = 684666786
Inst refs = 6730089151; Data refs = 3269910955

Number of references types: [Percentage]
       Reads  =      2689845793    [26.9%]
       Writes =      580065162     [5.8%]
       Inst.  =      6730089151    [67.3%]
       Total  =      10000000106

Total cycles for activities: [Percentage]
       Reads  =      14294526928   [42.9%]
       Writes =      3817508212    [11.5%]
       Inst.  =      15210740729   [45.6%]
       Total  =      33322775869

Average cycles for activities:
  Read =  5.3; Write =  6.6; Inst. =  5.0
Ideal: Exec. Time = 16730089257; CPI =  2.5
Ideal mis-aligned: Exec. Time = 21962901365; CPI = 3.3

Memory Level: L1i
       Hit Count = 11173122678  Miss Count = 34954210
       Total Requests = 11208076888
       Hit Rate = 99.7%   Miss Rate = 0.3%
       Kickouts = 30538088; Dirty Kickouts = 0; Transfers = 34954210
       Flush Kickouts  =  0

Memory Level: L1d
       Hit Count = 3894031543  Miss Count = 130703783
       Total Requests = 4024735326
       Hit Rate = 96.8%   Miss Rate = 3.2%
       Kickouts = 122396601; Dirty Kickouts = 34045528; Transfers = 134053937
       Flush Kickouts  =  3350154

Memory Level: L2
       Hit Count = 129575884  Miss Count = 73477791
       Total Requests = 203053675
       Hit Rate = 63.8%   Miss Rate = 36.2%
       Kickouts = 65717643; Dirty Kickouts = 13083056; Transfers = 76692919
       Flush Kickouts  =  3215128

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $925
Flushes = 17710 : Invalidates = 17710
```

```
---------------------------------------------------------------------
        libquantum.custom-L1-big         Simulation Results
---------------------------------------------------------------------

Memory System:
       Dcache Size = 16384 : ways = 1 : block size = 32
       Icache Size = 16384 : ways = 1 : block size = 32
       L2-cache Size = 32768 : ways = 1 : block size = 64
       Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 106974152978; Total References = 16506492546
Flush Time = 1326394708
Inst refs = 12487578510; Data refs = 4018914036

Number of references types: [Percentage]
       Reads  =     3526260463    [21.4%]
       Writes =     492653573    [3.0%]
       Inst.  =     12487578510   [75.7%]
       Total  =     16506492546

Total cycles for activities: [Percentage]
       Reads  =     87562952135   [81.9%]
       Writes =     1339755614    [1.3%]
       Inst.  =     18071445229   [16.9%]
       Total  =     106974152978

Average cycles for activities:
  Read =  24.8; Write =  2.7; Inst. =  8.6
Ideal: Exec. Time = 28994071056; CPI =  2.3
Ideal mis-aligned: Exec. Time = 35948584560; CPI = 2.9

Memory Level: L1i
       Hit Count = 16620543644  Miss Count = 845409
       Total Requests = 16621389053
       Hit Rate = 100.0%   Miss Rate = 0.0%
       Kickouts = 3465; Dirty Kickouts = 0; Transfers = 845409
       Flush Kickouts  =  0

Memory Level: L1d
       Hit Count = 6257208004  Miss Count = 582408993
       Total Requests = 6839616997
       Hit Rate = 91.5%   Miss Rate = 8.5%
       Kickouts = 565620956; Dirty Kickouts = 232210192; Transfers = 589145332
       Flush Kickouts  =  6736339

Memory Level: L2
       Hit Count = 528650240  Miss Count = 293550693
       Total Requests = 822200933
       Hit Rate = 64.3%   Miss Rate = 35.7%
       Kickouts = 276894007; Dirty Kickouts = 127218640; Transfers = 301169008
       Flush Kickouts  =  7618315

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $925
Flushes = 32862 : Invalidates = 32862
```

```
----------------------------------------------------------------------
        omnetpp.custom-L1-big      Simulation Results
----------------------------------------------------------------------

Memory System:
       Dcache Size = 16384 : ways = 1 : block size = 32
       Icache Size = 16384 : ways = 1 : block size = 32
       L2-cache Size = 32768 : ways = 1 : block size = 64
       Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 88442709126; Total References = 10000000076
Flush Time = 998488436
Inst refs = 6748671723; Data refs = 3251328353

Number of references types: [Percentage]
       Reads  =      2011922989    [20.1%]
       Writes =      1239405364    [12.4%]
       Inst.  =      6748671723    [67.5%]
       Total  =      10000000076

Total cycles for activities: [Percentage]
       Reads  =      44008736519   [49.8%]
       Writes =      10439721100   [11.8%]
       Inst.  =      33994251507   [38.4%]
       Total  =      88442709126

Average cycles for activities:
  Read =  21.9; Write =  8.4; Inst. =  13.1
Ideal: Exec. Time = 16748671799; CPI =  2.5
Ideal mis-aligned: Exec. Time = 24145770580; CPI = 3.6

Memory Level: L1i
       Hit Count = 11222038529  Miss Count = 237446544
       Total Requests = 11459485073
       Hit Rate = 97.9%   Miss Rate = 2.1%
       Kickouts = 230190909; Dirty Kickouts = 0; Transfers = 237446544
       Flush Kickouts  =  0

Memory Level: L1d
       Hit Count = 5656483223  Miss Count = 281130561
       Total Requests = 5937613784
       Hit Rate = 95.3%   Miss Rate = 4.7%
       Kickouts = 272077049; Dirty Kickouts = 124994277; Transfers = 285098227
       Flush Kickouts  =  3967666

Memory Level: L2
       Hit Count = 358132636  Miss Count = 289406412
       Total Requests = 647539048
       Hit Rate = 55.3%   Miss Rate = 44.7%
       Kickouts = 280369819; Dirty Kickouts = 73707604; Transfers = 293718037
       Flush Kickouts  =  4311625

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $925
Flushes = 17759 : Invalidates = 17759
```

```
---------------------------------------------------------------------
        sjeng.custom-L1-big        Simulation Results
---------------------------------------------------------------------

Memory System:
       Dcache Size = 16384 : ways = 1 : block size = 32
       Icache Size = 16384 : ways = 1 : block size = 32
       L2-cache Size = 32768 : ways = 1 : block size = 64
       Memory ready time = 30 : chunksize = 8 : chunktime = 15

Execute Time = 43950724974; Total References = 10000000109
Flush Time = 1254715713
Inst refs = 7364538494; Data refs = 2635461615

Number of references types: [Percentage]
       Reads  =     1907768017    [19.1%]
       Writes =     727693598     [7.3%]
       Inst.  =     7364538494    [73.6%]
       Total  =     10000000109

Total cycles for activities: [Percentage]
       Reads  =     11639182865   [26.5%]
       Writes =     7327593675    [16.7%]
       Inst.  =     24983948434   [56.8%]
       Total  =     43950724974

Average cycles for activities:
  Read =  6.1; Write =  10.1; Inst. =  6.0
Ideal: Exec. Time = 17364538603; CPI =  2.4
Ideal mis-aligned: Exec. Time = 23214492795; CPI = 3.2

Memory Level: L1i
       Hit Count = 12405895342  Miss Count = 146480450
       Total Requests = 12552375792
       Hit Rate = 98.8%   Miss Rate = 1.2%
       Kickouts = 138332948; Dirty Kickouts = 0; Transfers = 146480450
       Flush Kickouts  =  0

Memory Level: L1d
       Hit Count = 3190936834  Miss Count = 106641675
       Total Requests = 3297578509
       Hit Rate = 96.8%   Miss Rate = 3.2%
       Kickouts = 98817405; Dirty Kickouts = 49328953; Transfers = 111361755
       Flush Kickouts  =  4720080

Memory Level: L2
       Hit Count = 195693504  Miss Count = 111477654
       Total Requests = 307171158
       Hit Rate = 63.7%   Miss Rate = 36.3%
       Kickouts = 102429918; Dirty Kickouts = 24215057; Transfers = 116158303
       Flush Kickouts  =  4680649

L1 cache cost (Icache $400) + (Dcache $400) = $800
L2 cache cost = $50;   Memory Cost = $75   Total Cost = $925
Flushes = 19380 : Invalidates = 19380
```