**Cache Simulator Summary Report**

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a. For the cache itself, I created an array of structs that are memory allocated by the number of sets (2k) and that array consists of cache characteristics such as valid bit, dirty bit, LRU counter, and tag. Each cache characteristics array is memory allocated by the number of associations present. The number of bits for tag, index, and offset are calculated in the initializer function and are used to Cache characteristics array keeps track of whether the bit is valid, dirty, and keeps track of tag and manages the LRU when needed. LRU is incremented every time the cachesim\_access() is called. The LRU is set to 0 when the cache line is brought into an invalid set or when the cache is full, and a new line needs to be replaced.

b.

1) Plots for miss rate vs line size for every trace:

2) Comparing from the plots, the best configuration to achieve a lower miss rate seems to be the cache with 512 block sizes, 64K cache size, 8 associativity.

|  |  |  |  |
| --- | --- | --- | --- |
| Trace name | Overall miss rate | Read miss rate | Write miss rate |
| Trace.bubble | 0.001048 | 0.9067 | 0.0933 |
| Trace.merge | 0.0011346 | 0.8822 | 0.1177 |
| Trace.random64k | 0.0004883 | 1 | 0 |
| Trace.stream1M | 0.00781 | 1 | 0 |

3) Write back traffic also seems to work the best when the cache has the highest configurations which 512 block size, 64K cache size, 8 associativity.

|  |  |  |
| --- | --- | --- |
| Trace name | Writeback value | Writeback traffic |
| Trace.bubble | 5272 | 2699264 |
| Trace.merge | 7387 | 3782144 |
| Trace.random64K | 0 | 0 |
| Trace.stream1M | 0 | 0 |

4) The same trends follow for choosing the cache configurations (blocksize = 512, associativity = 8, cache size = 64K) for computing total memory access volume.

|  |  |  |  |
| --- | --- | --- | --- |
| Trace name | Total memory access volume (bytes) | Total bytes fetched (bytes) | Memory access volume saved (bytes) |
| Trace.bubble | 3392512 | 3237039616 | 3233647104 |
| Trace.merge | 4460544 | 3931356160 | 3926895616 |
| Trace.random64K | 65536 | 134217728 | 134152192 |
| Trace.stream1M | 1048676 | 134217728 | 133169152 |