Bresia Prudente
bprude2

1. The two important memory references that the cache exploits are spatial locality of reference and temporal locality of reference. Spatial locality of reference is referred to a specific data item that's being referenced and the data nearby that can be accessed in a short time period as well. Temporal locality is when a data item is accessed from the main memory stored in the cache which is accessed from the main memory and stored in the cache which is then referenced again. This occurs mainly in instruction loops and local variables. When the item is fetched and stored into the cache for the first time, the CPU will search for it in the cache and won't have access to it from the main memory.

2. Fully Associative
   cache size = 128 = $2^7$ bytes
   cache line size = 2 words = ((4 bytes)*2) = 8 bytes = ($2^3$)
   offset = 3
   index bits = 0
   tag = 32 - 3 = 29

   Direct Mapped
   cache size = 128 = $2^7$ bytes
   cache line size = 2 words = ((4 bytes)*2) = 8 bytes = $2^3$
   number of cache lines = (($2^7$) bytes)/(($2^3$)bytes) = 16 = $2^4$
   offset bits = 3
   index bits = 4
   tag bits = 32 - 2 - 4 = 25

   4-way Associative
   cache size = 128 bytes = $2^7$ bytes
   cache line size = 2 words - ((4 bytes)*2) = 8 bytes = $2^3$
   number of cache lines (($2^7$bytes)/(8*4) = ($2^7$)/($2^5$) = 4 = $2^2$
   offset = 3
   index bits = 2
   tag = 32 - 3 - 2 = 27

3. miss rate = misses/(misses + hits)
   a. Fully Associative = 7/(7+3) = 0.7 = 70%
   b. Direct Mapped = 6/(6+4) = 0.6 = 60%
   c. 4-Way Associative = 4/(4+6) = 0.4 = 40%