**BPDC, Dubai - First Semester, 2021-2022**

**DEPARTMENT OF CS**

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| **Course No: CS F342** |  | **Course Title: Computer Architecture** |

Tutorial#14

1. For a cache, that has a miss rate of 3% and miss penalty of 500 cycles. In a program 50% of the instructions are memory accesses (load-store)
2. Find the misses per 1000 instruction (MPKI)
3. Find memory stall cycles per miss

Miss rate(MR): #misses/#memory accesses = (miss/instruction)/(memory access / instruction)

Miss Rate = MPI/MAPI MPI = MR x MAPI ( MAPI = 1.5 )

= 0.03 x 1.5 = 0.045

1. MPKI = MPI x 1000 = 45

b. Memory stall cycles per miss = MR x MP = 0.03 x 500 = 15cycles.

1. Consider a 32 bit processor with 16KB direct mapped L1-cache that uses a block size of 4 words. It has an L2-cache of 256 KB with 4-way associativity and block size of 8 words. The system uses a byte addressable 256MB DRAM system. Upon running a program, 16 consecutive fixed length instructions(each instruction is one word) starting at main memory address 0x 8226620 are executed. These instructions operate on an array A of 8 words, with starting address 0x42AF5F8. Assuming caches are initially empty; indicate the non empty sets on L1 cache and L2 cache after the execution of the program.

Given: 32bit processor; 1word = 4Bytes; 256MB DRAM = 28bit address

L1 cache: 16KB, direct mapped, block size = 4 Words(16B)

#sets L1 = 214 / 24 x 1 = 210  Tag: 14 Index: 10 Block Offset: 4 bits(2+2)

L2 cache: 256KB, 4-way, block size = 8 Words(32B)

#sets L2: 218 / 25 x 22 = 218 / 27 = 211 Tag: 12 Index: 11 Block Offset: 5 bits (3+2)

Upon running a program, **16** consecutive fixed length instructions (each instruction is one word) starting at main memory address **0x 8226620** are executed. These instructions operate on an **array A of 8 words**, with starting address **0x42AF5F8**.

**L1:** Tag+Index+Block-offset = 14+**10+4**

0x 8226620 = > 1000 0010 0010 0110 0110 0010 0000

#610

Line or Set #610, #611, #612, #613, will have 4 Instruction words each, so totally 16 instructions.

For Data, 0x42AF5F8 = > 0100 0010 1010 1111 0101 1111 1000

#863 = > 2 words,

#864 = > 4 words,

#865 = > 2 words of the data array A

**L2:** Tag+Index+Block-offset = 12+**11+5**

0x 8226620 = > 1000 0010 0010 0110 0110 0010 0000

#817

Line or Set #817, #818 will have 8 Instruction words each, so totally 16 instructions.

For Data, 0x42AF5F8 = > 0100 0010 1010 1111 0101 1111 1000

#1967 = > 2 words,

#1968 = > 6 words of the data array A