MICROPROCESSOR AND COMPUTER ARCHITECTURE LABORATORY

UE19CS256

4th Semester, Academic Year 2020-21

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Date: 21-04-2021

Week#9

Program Number: ____1__

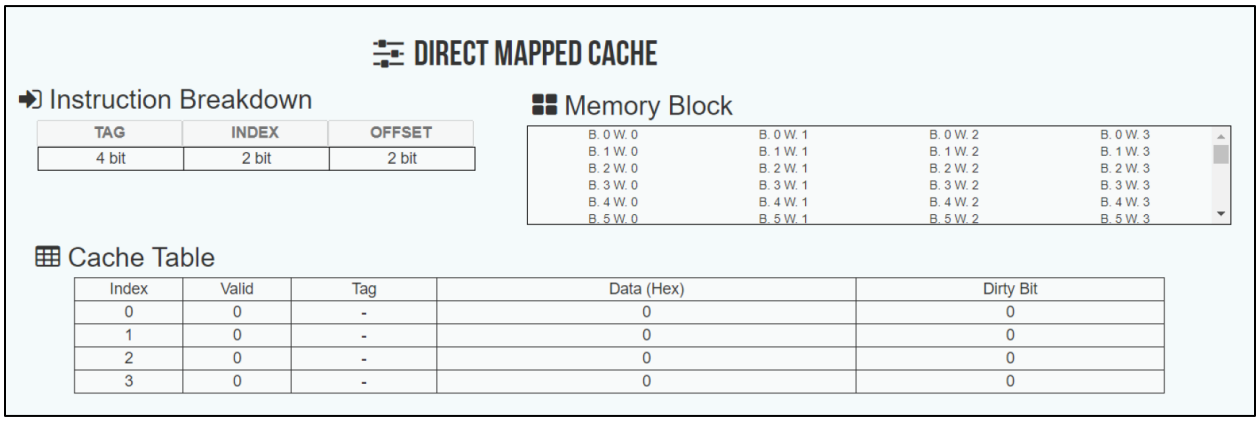
Consider a direct mapped cache of size 16 bytes with block size 4 bytes. The size of main memory is 256 bytes. Find Number of bits in tag, index and offset. The processor generates requests as follows

1,4,8,5,14,11,13,38,9,B,4,2B,5,6,9,11.

Find hit rate and miss rate.

a) Cache Address Table showing the splitup of the address fields for the requests generated by the processor

b) Screenshot showing the Cache Table



DIRECT MAPPED CACHE

Instruction Breakdown

TAG	INDEX	OFFSET
4 bit	2 bit	2 bit

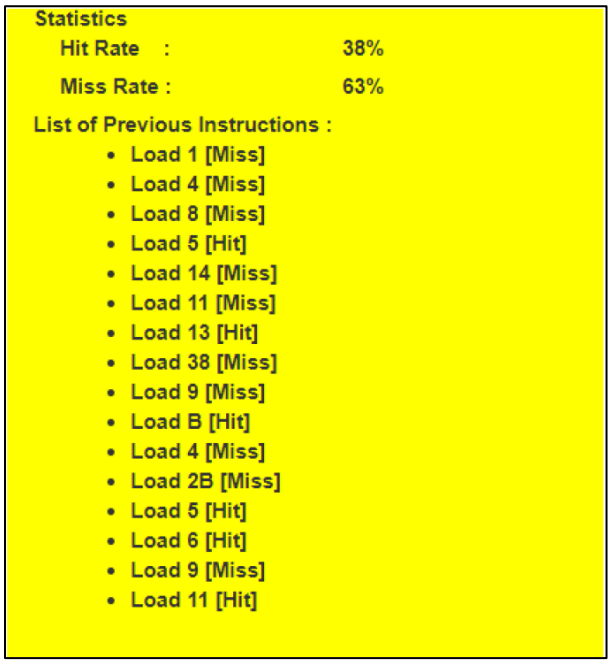
Memory Block

B. 0 W. 0	B. 0 W. 1	B. 0 W. 2	B. 0 W. 3
B. 1 W. 0	B. 1 W. 1	B. 1 W. 2	B. 1 W. 3
B. 2 W. 0	B. 2 W. 1	B. 2 W. 2	B. 2 W. 3
B. 3 W. 0	B. 3 W. 1	B. 3 W. 2	B. 3 W. 3
B. 4 W. 0	B. 4 W. 1	B. 4 W. 2	B. 4 W. 3
B. 5 W. 0	B. 5 W. 1	B. 5 W. 2	B. 5 W. 3

Cache Table

Index	Valid	Tag	Data (Hex)	Dirty Bit
0	0	-	0	0
1	0	-	0	0
2	0	-	0	0
3	0	-	0	0

c) Screenshot showing hit and miss rates



Statistics

Hit Rate : 38%

Miss Rate : 63%

List of Previous Instructions :

- Load 1 [Miss]
- Load 4 [Miss]
- Load 8 [Miss]
- Load 5 [Hit]
- Load 14 [Miss]
- Load 11 [Miss]
- Load 13 [Hit]
- Load 38 [Miss]
- Load 9 [Miss]
- Load B [Hit]
- Load 4 [Miss]
- Load 2B [Miss]
- Load 5 [Hit]
- Load 6 [Hit]
- Load 9 [Miss]
- Load 11 [Hit]

Program Number: ____2__

Consider a direct mapped cache of size 16 KB with block size 256 bytes. The size of main memory is 128 KB. Find Number of bits in tag. Randomly generate 10 addresses and find hit rate and miss rate.

a) Cache Address Table showing the splitup of the address fields for the requests generated by the processor

Instruction Breakdown

TAG	INDEX	OFFSET
3 bit	6 bit	8 bit

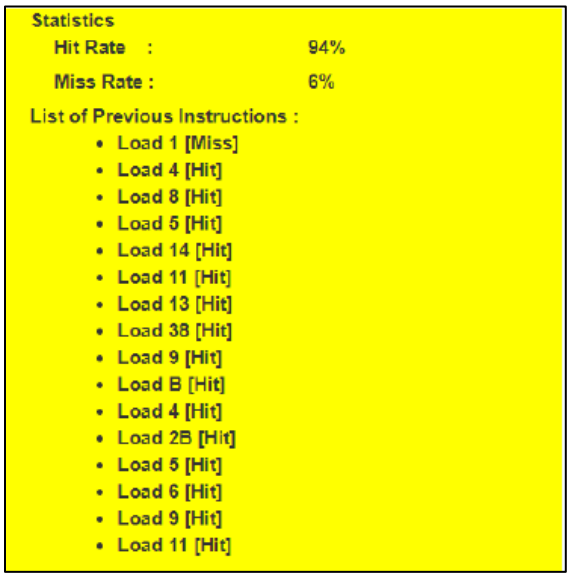
b) Screenshot showing the Cache Table

Cache Table

Index	Valid	Tag	Data (Hex)	Dirty Bit
0	0	-	0	0
1	0	-	0	0
2	0	-	0	0
3	0	-	0	0
4	0	-	0	0
5	0	-	0	0
6	0	-	0	0
7	0	-	0	0
8	0	-	0	0
9	0	-	0	0
10	0	-	0	0
11	0	-	0	0
12	0	-	0	0
13	0	-	0	0
14	0	-	0	0
15	0	-	0	0
16	0	-	0	0
17	0	-	0	0
18	0	-	0	0
19	0	-	0	0
20	0	-	0	0
21	0	-	0	0
22	0	-	0	0
23	0	-	0	0
24	0	-	0	0
25	0	-	0	0
26	0	-	0	0
27	0	-	0	0

28	0	-	0	0
29	0	-	0	0
30	0	-	0	0
31	0	-	0	0
32	0	-	0	0
33	0	-	0	0
34	0	-	0	0
35	0	-	0	0
36	0	-	0	0
37	0	-	0	0
38	0	-	0	0
39	0	-	0	0
40	0	-	0	0
41	0	-	0	0
42	0	-	0	0
43	0	-	0	0
44	0	-	0	0
45	0	-	0	0
46	0	-	0	0
47	0	-	0	0
48	0	-	0	0
49	0	-	0	0
50	0	-	0	0
51	0	-	0	0
52	0	-	0	0
53	0	-	0	0
54	0	-	0	0
55	0	-	0	0
56	0	-	0	0
57	0	-	0	0
58	0	-	0	0
59	0	-	0	0
60	0	-	0	0
61	0	-	0	0
62	0	-	0	0
63	0	-	0	0

c) Screenshot showing hit and miss rates



Program Number: ____3__

A computer system uses 16-bit memory addresses. It has a 2K-byte cache organized in a direct-mapped manner with 64 bytes per cache block. Assume that the size of each memory word is 1 byte.

a) Calculate the number of bits in each of the Tag, Block, and Word fields of the memory address.

(b) When a program is executed, the processor reads data sequentially from the following word addresses: 128, 144, 2176, 2180, 128, 2176 All the above addresses are shown in decimal values. Assume that the cache is initially empty. For each of the above addresses, indicate whether the cache access will result in a hit or a miss.

a) Cache Address Table showing the splitup of the address fields for the requests generated by the processor

Instruction Breakdown

TAG	INDEX	OFFSET
5 bit	5 bit	6 bit

b) Screenshot showing the Cache Table

Cache Table

Index	Valid	Tag	Data (Hex)	Dirty Bit
0	0	-	0	0
1	0	-	0	0
2	0	-	0	0
3	0	-	0	0
4	0	-	0	0
5	0	-	0	0
6	0	-	0	0
7	0	-	0	0
8	0	-	0	0
9	0	-	0	0
10	0	-	0	0
11	0	-	0	0
12	0	-	0	0
13	0	-	0	0
14	0	-	0	0
15	0	-	0	0
16	0	-	0	0
17	0	-	0	0
18	0	-	0	0
19	0	-	0	0
20	0	-	0	0
21	0	-	0	0
22	0	-	0	0
23	0	-	0	0
24	0	-	0	0
25	0	-	0	0
26	0	-	0	0
27	0	-	0	0
28	0	-	0	0
29	0	-	0	0
30	0	-	0	0

c) Screenshot showing hit and miss rates

Statistics

Hit Rate : 33%

Miss Rate : 67%

List of Previous Instructions :

- Load 128 [Miss]
- Load 144 [Miss]
- Load 2176 [Miss]
- Load 2180 [Miss]
- Load 128 [Hit]
- Load 2176 [Hit]

Program Number: ___4__

Consider a 2-way set associative cache of size 16 KB with block size 256 bytes. The size of main memory is 128 KB. Find Number of bits in tag. Randomly generate 10 addresses and find hit rate and miss rate.

a) Cache Address Table showing the splitup of the address fields for the requests generated by the processor

Instruction Breakdown

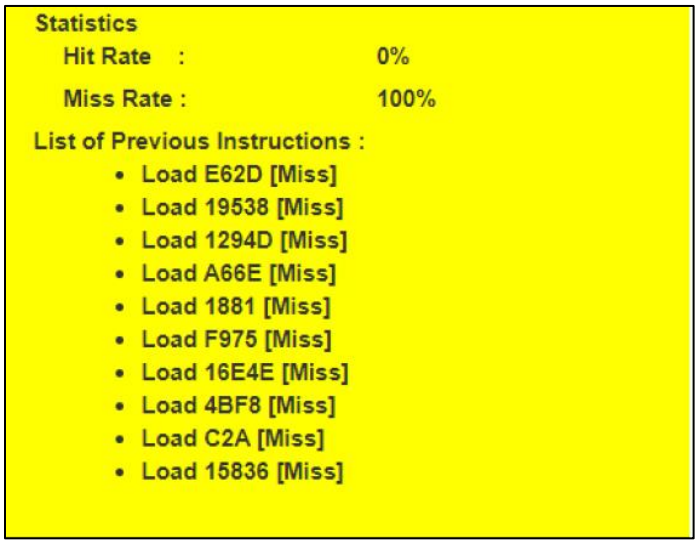
TAG	INDEX	OFFSET
4 bit	5 bit	8 bit

b) Screenshot showing the Cache Table

Cache Table

Index	Valid	Tag	Data (Hex)	Dirty Bit	Index	Valid	Tag	Data (Hex)	Dirty Bit
0	0	-	0	0	0	0	-	0	0
1	0	-	0	0	1	0	-	0	0
2	0	-	0	0	2	0	-	0	0
3	0	-	0	0	3	0	-	0	0
4	0	-	0	0	4	0	-	0	0
5	0	-	0	0	5	0	-	0	0
6	0	-	0	0	6	0	-	0	0
7	0	-	0	0	7	0	-	0	0
8	0	-	0	0	8	0	-	0	0
9	0	-	0	0	9	0	-	0	0
10	0	-	0	0	10	0	-	0	0
11	0	-	0	0	11	0	-	0	0
12	0	-	0	0	12	0	-	0	0
13	0	-	0	0	13	0	-	0	0
14	0	-	0	0	14	0	-	0	0
15	0	-	0	0	15	0	-	0	0
16	0	-	0	0	16	0	-	0	0
17	0	-	0	0	17	0	-	0	0
18	0	-	0	0	18	0	-	0	0
19	0	-	0	0	19	0	-	0	0
20	0	-	0	0	20	0	-	0	0
21	0	-	0	0	21	0	-	0	0
22	0	-	0	0	22	0	-	0	0
23	0	-	0	0	23	0	-	0	0
24	0	-	0	0	24	0	-	0	0
25	0	-	0	0	25	0	-	0	0
26	0	-	0	0	26	0	-	0	0
27	0	-	0	0	27	0	-	0	0
28	0	-	0	0	28	0	-	0	0
29	0	-	0	0	29	0	-	0	0
30	0	-	0	0	30	0	-	0	0
31	0	-	0	0	31	0	-	0	0

c) Screenshot showing hit and miss rates



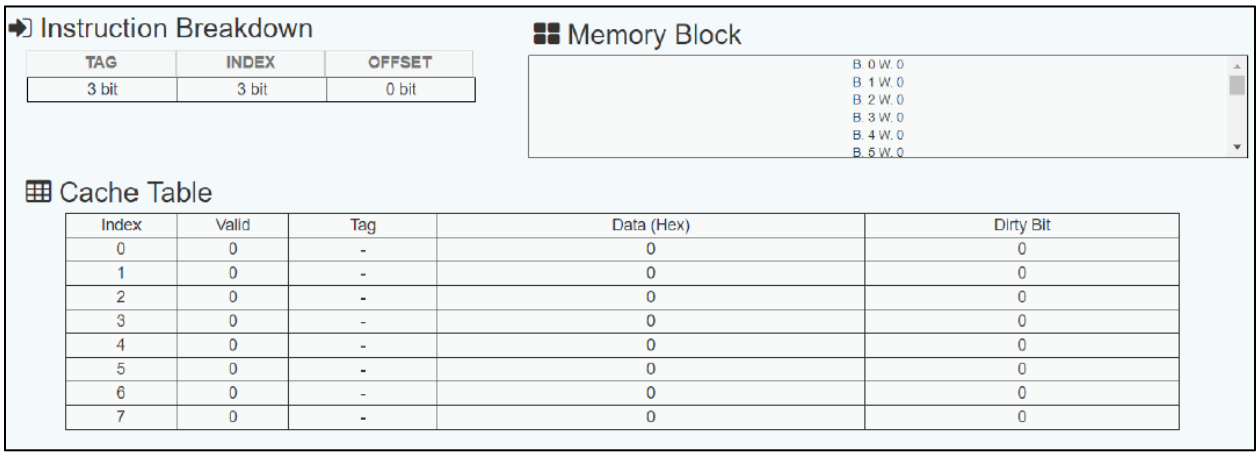
Program Number: ___5__

Consider a main memory having 64 byte capacity and cache memory of 8 bytes initially empty .The following addresses are generated by the CPU. All values in hexadecimal. Clearly label data that is replaced in cache lines

Show the cache memory table and filled data in the cache lines of block size 1 byte. LRU Policy is used.

The cache is mapped as

a) Direct Mapped



Index	Valid	Tag	Data (Hex)	Dirty Bit
0	0	-	0	0
1	0	-	0	0
2	0	-	0	0
3	0	-	0	0
4	0	-	0	0
5	0	-	0	0
6	0	-	0	0
7	0	-	0	0

Statistics

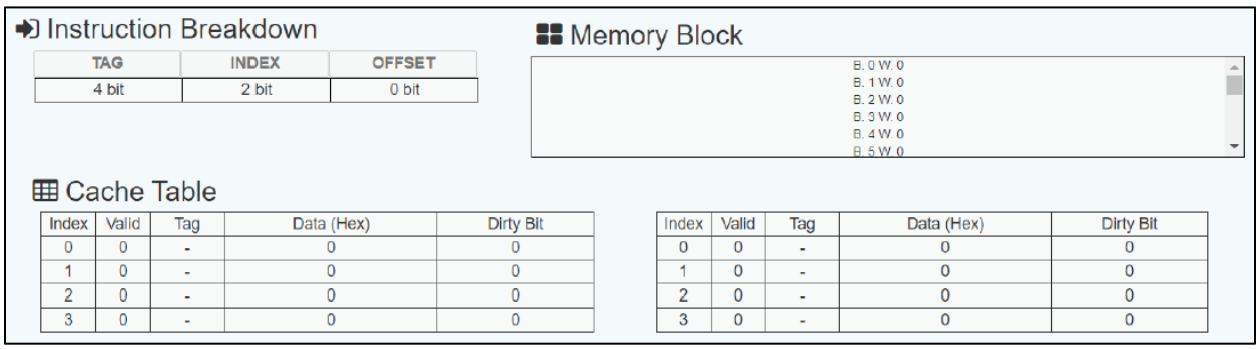
Hit Rate : 13%

Miss Rate : 87%

List of Previous Instructions :

- **Load 1 [Miss]**
- **Load 4 [Miss]**
- **Load 8 [Miss]**
- **Load 5 [Miss]**
- **Load 14 [Miss]**
- **Load 11 [Miss]**
- **Load 13 [Miss]**
- **Load 38 [Miss]**
- **Load 9 [Miss]**
- **Load B [Miss]**
- **Load 4 [Miss]**
- **Load 2B [Miss]**
- **Load 5 [Hit]**
- **Load 6 [Miss]**
- **Load 9 [Hit]**

b) Two way set Associative



Statistics

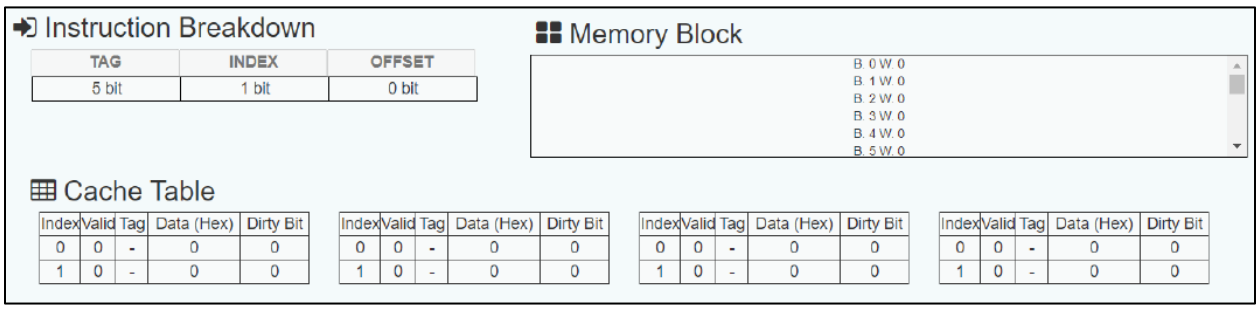
Hit Rate : 6%

Miss Rate : 94%

List of Previous Instructions :

- Load 1 [Miss]
- Load 4 [Miss]
- Load 8 [Miss]
- Load 5 [Miss]
- Load 14 [Miss]
- Load 11 [Miss]
- Load 13 [Miss]
- Load 38 [Miss]
- Load 9 [Miss]
- Load B [Miss]
- Load 4 [Miss]
- Load 2B [Miss]
- Load 5 [Miss]
- Load 6 [Miss]
- Load 9 [Hit]
- Load 11 [Miss]

c) Four Way Set associative



Statistics

Hit Rate : **13%**

Miss Rate : **87%**

List of Previous Instructions :

- **Load 1 [Miss]**
- **Load 4 [Miss]**
- **Load 8 [Miss]**
- **Load 5 [Miss]**
- **Load 14 [Miss]**
- **Load 11 [Miss]**
- **Load 13 [Miss]**
- **Load 38 [Miss]**
- **Load 9 [Miss]**
- **Load B [Miss]**
- **Load 4 [Hit]**
- **Load 2B [Miss]**
- **Load 5 [Miss]**
- **Load 6 [Miss]**
- **Load 9 [Hit]**

d) Fully Associative

Instruction Breakdown

BLOCK	OFFSET
6 bit	0 bit

Memory Block

B. 0 W. 0
B. 1 W. 0
B. 2 W. 0
B. 3 W. 0
B. 4 W. 0
B. 5 W. 0

Cache Table

Index	Valid	Tag	Data (Hex)	Dirty Bit
0	0	-	0	0
1	0	-	0	0
2	0	-	0	0
3	0	-	0	0
4	0	-	0	0
5	0	-	0	0
6	0	-	0	0
7	0	-	0	0

Statistics

Hit Rate : 6%

Miss Rate : 94%

List of Previous Instructions :

- Load 1 [Miss]
- Load 4 [Miss]
- Load 8 [Miss]
- Load 5 [Miss]
- Load 14 [Miss]
- Load 11 [Miss]
- Load 13 [Miss]
- Load 38 [Miss]
- Load 9 [Miss]
- Load B [Miss]
- Load 4 [Miss]
- Load 2B [Miss]
- Load 5 [Miss]
- Load 6 [Miss]
- Load 9 [Hit]
- Load 11 [Miss]

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