Question no. 1

Consider a cache that can store 4 words,
Consider a Main Memory of 64 words
For the following addresses of RAM accesses, find the hits and misses using direct mapping:

10, 12, 10, 12, 63, 58, 34, 10, 34, 63, 33, 10, 63

No. of bits of Main Memory Address = $\log_2(64)$
= 6 bits

No. of bits of Tag = $\log_2(64/4)$ = 4 bits

No. of bits of Index = 6 bits − 4 bits = 2 bits

10 (Miss)

$$4 \overline{)10}\ 2,\ 8,\ 2$$

Tag = 10 / 4 = 2 = 0010
Index = 10 % 4 = 2 = 10

Address = 0010 10
T I

12 (Miss)

Tag = 12 / 4 = 3 = 0011
Index = 0 = 00
Address = 001100

10 (Hit)

12 (Hit)

63 (Miss)

Tag: 63/4 = 15 = 1111

Index = 63 % 4 = 3 = 11

Address: 111111

58 (Miss)

Tag: 58/4 = 14 = 1110

Index = 58 % 4 = 2 = 10

Address: 111010

34 (Miss)

Tag = 34/4 = 8 = 1000

Index = 34 % 4 = 2 = 10

Address = 100010

10 (Miss)

34 ~~(Hit)~~ (Miss)

63 ~~(Hit)~~

33 (Miss)

Tag = 33/4 = 8 = 1000

Index = 33 % 4 = 1 = 01

Address = 100001

10 ~~(Hit)~~ (Miss)

63 (Hit)

	Tag	Data	Value Bit
0 = 00	0011	12	0
1 = 01	1000	33	0
2 = 10	~~0010 1110 1000~~ ~~0010 1000~~ 0010	~~10 58 34 10~~ ~~34 10~~	0
3 = 11	1111	63	0

Question: 2

Find the hits and misses using Associative Mapping: (LRU) is used as replacement policy

No. of Tag bits = $\log_2(64) = 6$ bits

10 (Miss) 12 (Miss) 10 (Hit) 12 (Hit) 63 (Miss)

58 (Miss) 34 (Miss) 10 (Miss) 34 (Hit) 63 (Hit)

33 (Miss) 10 (Hit) 63 (Hit)

	Tag	Data	Value Bit
00	~~001010~~ 100010	~~10~~ 34	0
01	~~001100~~ 001010	~~12~~ 10	0
10	111111	63	0
11	~~111010~~ 100001	~~58~~ 33	0

Question : 3

Set bits = 1 = $\log_2(2)$
Tag bits = 5

Find the hits and misses using 2 way set associative mapping:

(LRU) is used as replacement policy

10 (Miss) 12 (Miss) 10 (Hit) 12 (Hit) 63 (Miss)

58 (Miss) 34 (Miss) 10 (Miss) 34 (Hit) 63 (Hit)

33 (Miss) 10 (Hit) 63 (Hit)

Index bits = 2
Tag bits = 4

Here size of cache is 4
No. of sets = $\frac{4}{2}$ = 2 set → 2way Associative

Here we use k mod n → no. of sets

Address

	S1 Tag	S1 Data	S1 Value Bit	S2 Tag	S2 Data	S2 Value Bit
00	0011	12	0			
01	1000	33	0			
10	~~0010~~ 1000	~~10~~ 34	0	~~1110~~ 0010	~~58~~ 10	0
11	1111	63	0			

Set	Tag	Data	Value Bit	Tag	Data	Value Bit
0	~~00101~~ ~~11100~~ 00101	~~10 58~~ 10	0	~~00110~~ 10001	~~12~~ 34	0
1	11111	63	0	10000	33	0