Question 1: Using the “Direct Mapped Cache”, assume that

- 4-blocks, 1 word/block, direct mapped
- Initial state is empty as shown below.

Index	V	Tag	Data
00	N		
01	N		
10	N		
11	N		

And the following addresses have been requested in the following sequences:

Request 1: Word Addresses 4, 5 and 7

Request 2: Word Addresses 0, 1 and 3

Request 3: Word Addresses 1, 2 and 3

Request 4: Word Addresses 3, 4 and 6

A) Show the cache state **Before** and **After** each time that addresses have been requested.

B) Calculate the Hit Ratio and Miss Ratio.

Hint: Follow the example in the next page and fill up all missing data accordingly and calculate the Hit and Miss ratios.

Request 1:

Word addr	Binary addr	Hit/miss	Cache block
4	100	Miss	00
5	101	Miss	01
7	111	Miss	11

Before				After			
Index	V	Tag	Data	Index	V	Tag	Data
00	N			00	Y	1	Mem[100]
01	N			01	Y	1	Mem[101]
10	N			10	N		
11	N			11	Y	1	Mem[111]

Request 2:

Word addr	Binary addr	Hit/miss	Cache block
0	000	Miss	00
1	001	Miss	01
3	011	Miss	11

Before				After			
Index	V	Tag	Data	Index	V	Tag	Data
00	Y	1	Mem[100]	00	Y	0	Mem[000]
01	Y	1	Mem[101]	01	Y	0	Mem[001]
10	N			10	N		
11	Y	1	Mem[111]	11	Y	0	Mem[011]

Request 3:

Word addr	Binary addr	Hit/miss	Cache block
1	001	Hit	00
2	010	Miss	10
3	011	Hit	11

Before				After			
Index	V	Tag	Data	Index	V	Tag	Data
00	Y	0	Mem[000]	00	Y	0	Mem[000]
01	Y	0	mem[001]	01	Y	0	mem[001]
10	N			10	Y	0	mem[010]
11	Y	0	mem[011]	11	Y	0	mem[011]

Request 4:

Word addr	Binary addr	Hit/miss	Cache block
3	011	Hit	11
4	100	Miss	00
6	110	Miss	10

Before				After			
Index	V	Tag	Data	Index	V	Tag	Data
00	Y	0	mem[000]	00	Y	1	Mem[100]
01	Y	0	mem[001]	01	Y	0	mem[001]
10	Y	0	mem[010]	10	Y	1	mem[110]
11	Y	0	mem[011]	11	Y	0	mem[011]

No of Cache access : 12 **No. of Hits:** 3 **No. of Misses :** 9

Hit Ratio : $\frac{\text{Hits}}{\text{cache access}} = \frac{3}{12} = 25\%$

Miss Ratio : $\frac{\text{Miss}}{\text{cache access}} = \frac{9}{12} = 75\%$ or = Miss = 1 − Hits, 1 − 0.25 = 0.75