1A) 4k/4 = 1024 blocks in cache

#bits in index = log 1024==10

#bit in offset == 2 (log 4)

#bit in tag = 20

1B) #numbits ==

1C)

2A) 32k/32== 1024 blocks in cache

#bits in index = log 1024== 10

#bits in offset = 5 (log 32)

#bits in tag = 20

2B)

2C) Given 32KB direct-mapped data cache with 32-byte blocks.

Total number of blocks is = 32KB / 32B = 1 K = 1024

**Hence we have a total of 1024 blocks.**

Hence Index is = log2 Number of blocks = log2 1024 = log2 210 = 10

**Hence Index of the address is 10 bits.**

Given block is 32 byte Hence offset is = log2 32 = log2 25 = 5

**Hence offset of the address is 5 bits.**

Tag of the address is = Total address length - ( Index + Offset)

                               = 32 - ( 10 + 5 )

                               = 32 - 15 = 17

**Hence Tag of the address is 17 bits.**

Given address are as below

        1) 0x48014554

                 0100 1000 0000 0001 0100 0101 0101 0100 in binary

                 1st 17 bits are TAG **0100 1000 0000 0001 0**

 next 10 bits are Index **100 0101 010**

 next 5 bits are offset **1 0100**

**This is a Miss (assuming cache is initially empty).**

        2) 0x48014548

                 0100 1000 0000 0001 0100 0101 0100 1000 in binary

                 1st 17 bits are TAG **0100 1000 0000 0001 0**

 next 10 bits are Index **100 0101 010**

 next 5 bits are offset **0 1000**

**This is a Hit (As the block with same TAG is already present in the cache (1st reference) ).**

        3) 0x48014754

                 0100 1000 0000 0001 0100 0111 0101 0100 in binary

                 1st 17 bits are TAG **0100 1000 0000 0001 0**

 next 10 bits are Index **100 0111 010**

 next 5 bits are offset **1 0100**

**This is a Hit (As the block with same TAG is already present in the cache (1,2 reference) ).**

        4) 0x48034760

                 0100 1000 0000 0011 0100 0111 0110 0000 in binary

                 1st 17 bits are TAG **0100 1000 0000 0011 0**

 next 10 bits are Index **100 0111 011**

 next 5 bits are offset **0 0000**

**This is a Miss (assuming cache is initially empty).**

        5) 0x48014554

                0100 1000 0000 0001 0100 0101 0101 0100 in binary

                 1st 17 bits are TAG **0100 1000 0000 0001 0**

 next 10 bits are Index **100 0101 010**

 next 5 bits are offset **1 0100**

**This is a Hit (As the block with same TAG is already present in the cache (1,2,3 reference) ).**

        6) 0x48014560

                 0100 1000 0000 0001 0100 0101 0110 0000 in binary

                 1st 17 bits are TAG **0100 1000 0000 0001 0**

 next 10 bits are Index **100 0101 011**

 next 5 bits are offset **0 0000**

**This is a Hit (As the block with same TAG is already present in the cache (1,2,3,5 reference) ).**

        7) 0x48014760

                 0100 1000 0000 0001 0100 0111 0110 0000 in binary

                 1st 17 bits are TAG **0100 1000 0000 0001 0**

 next 10 bits are Index **100 0111 011**

 next 5 bits are offset **0 0000**

**This is a Hit (As the block with same TAG is already present in the cache (1,2,3,5,6 reference) ).**

        8) 0x48014554

                  0100 1000 0000 0001 0100 0101 0101 0100 in binary

                 1st 17 bits are TAG **0100 1000 0000 0001 0**

 next 10 bits are Index **100 0101 010**

 next 5 bits are offset **1 0100**

**This is a Hit (As the block with same TAG is already present in the cache (1,2,3,5,6,7 reference) ).**