I honestly will not do any cheating.   송인경 *(signature)*

Q1) Because Cache can help speed up by lower gap between CPU and main memory's speed. It has small capacity but fast.

Q2) It deals with the potential speed up of a program using multiple processors compared to a single processor. The law indicates the amount of speedup as a function of the fraction of code that can be executed in parrelled.

Q3) SAAS is Software as a Service. It provides service to customers in form of a software, specifically application software, running on and accessible in the cloud.

Q4) There are cell phone, tooth brushes, video cameras, calculator, washing machines.

Q5) It means that split caches into 2 caches; one dedicated to instructions and one dedicated to data.

Q6)

0	7	23
opcode	address	
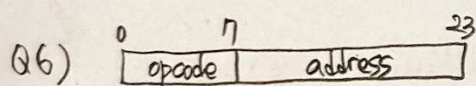
1) IR : 24 bits , PC : 16 bits

A
10
1010

2)   01110000 1010 1010 1111 1111

3) 10101010 0011 1111 1111 0011

Q7) $CPI = \dfrac{60000 \times 1 + 40000 \times 2 + 70000 \times 3 + 30000 \times 2}{200000}$

$= \dfrac{(6+8+21+6)\,10000}{\dfrac{200000}{20}} = \dfrac{41}{20} = 2.05$

$MIPS = \dfrac{I_c}{T \times 10^6}$, $[T = I_c \times CPI \times t]$

$= \dfrac{f}{CPI \times 10^6} = \dfrac{100 \times 10^6}{2.05 \times 10^6} = \dfrac{20}{100} \times \dfrac{100}{\dfrac{205}{41}} = \dfrac{2000}{41}$

$T = I_c \times CPI \times t = I_c \times CPI \times \dfrac{1}{f}$

$= 200000 \times 2.05 \times \dfrac{1}{100 \times 10^6} = 0.2 \times 2.05 \times 10^{-2} = 41 \times 10^{-5}$

Q8) 1) $\dfrac{1}{100MHZ} = \dfrac{1}{10^8} = 10^{-8}$

∴ 30 ns are needed.

2) $100/3 = 33.3 MB/S$

3) $100/5 = 20 MB/S$

Q9) 1 block = 4 words

2^{23} byte / 2^3 byte = 2^{20} byte → $2^{20}/2^2 = 2^{18}$ [block]

1 word = 64 bit = 8 Byte   (18) $2^{18}/2^2 = 2^{16}$

a)

Tag	Set	word
4	16	3

23 − 16 − 3 = 4

b)

Tag	Set	word
4	16	3
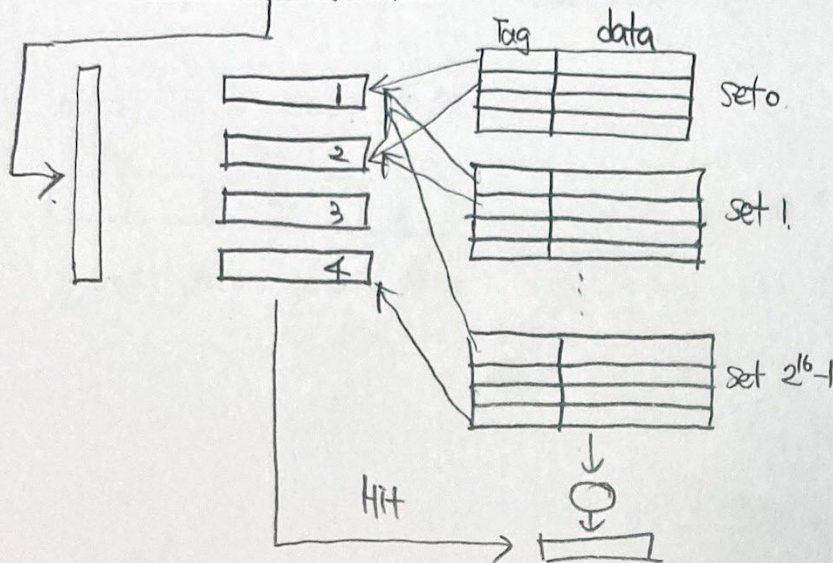
c) When we add 2 bits LRU, if the data hits, it changes to "1".
And others are zero or 1. LRU means "least recently used". So,
least recently used, (LRU 2bits are "00") will replaced first.

Q10)   1 word = 1 Byte,   1 block = 8 Byte = 8 word

[Direct-map] 32 lines = 2^5 64K = 2^{16}

a)

Tag	line	word
8	5	3

b)   0001 0001 / 0001 1/011   (slot 3)

     1100 0011 / 0011 0/100   (slot 6)

c)   0001 1010 0001 1010 ~ 0001 1010 0001 1111 are stored.

Q(0) d) 256 bytes

e) 0001 1010 0001 1010

TAG	word
13	3

0/001 1/010 0/001 1/010 ⇒ | 0343 | : Tag

f) 0001 1010 0001 1010.

Tag	Set	word
9	4	3

0/001 1/010 0/001 1/010   Tag : | 034 | Set : | 3 |

Q11)

	time	probability
cache	9 ns	0.9
main o , cacheX	80ns+9ns	(0.1)(0.6)
mainX , cacheX	12ms+80ns+9ns	(0.1)(0.4)

∴ 9ns(0.9) + 89ns(0.06) + (12,000,089)ns (0.04)

= (81+534+48,000,356) ns × 10⁻²

$$= 9ns(0.9) + 89ns(0.06) + (12{,}000{,}089)ns\,(0.04)$$

$$= (81 + 534 + 48{,}000{,}356)\,ns \times 10^{-2}$$

$$= (48{,}001{,}700) \times 10^{-2}\,ns = 480017\,ns$$

9 89
× 6
534

+ 810
1344
356
1700