Q) color display – 8 bits of each primary color (RGB) per pixel.
frame size – 1280×1024.

(a) minimum size in bytes of the frame buffer to store a frame

Ans → 1 byte = 8 bits

∵ 3 colors, each using 8 bits = 1 byte.

∴ one pixel uses 3×1 bytes = 3 bytes.

∵ 3 colors and each color uses 1 byte. Also, the frame consists of

$1280 \times 1024 = 1310720$ pixels

∴ (memory) size of the frame is

$3 \times 1310720 = 3{,}932{,}160$ ~~pixels~~ bytes.

Finally, this means precisely that the minimum size of the frame buffer is $\boxed{3{,}932{,}160 \text{ bytes}}$

Assn 1 →

3 colors, each using 10 bits

3×10 bits = 30 bits

frame $3440 \times 1440 = 4{,}953{,}600$ pixels

∴ minimum size of frame is

$30 \times 4{,}953{,}600 = 148{,}608{,}000$ bits

$= \boxed{18{,}576{,}000 \text{ bytes}}$

(b) how long would it take, at a minimum, for the frame to be sent over a 100 Mbit/s?

1 Mbit/s = 10^6 bit/s, so speed is

100 Mbit/s = 100×10^6 bit/s = 10^8 bit/s

(memory) size of the frame in bits is

$3932160 \times 8 = 31457280$ bits

$\therefore$ speed = $\frac{\text{size}}{\text{time}}$. where size is the memory size of the object being sent

we have time = $\frac{\text{size}}{\text{speed}}$

$= \frac{31457280}{10^8 \text{ bits/s}}$

$= \boxed{0.31457280 s}$

Assn 1 :

(b) 400 Mbit/s

Speed : 400×10^6 bits/s = 4×10^8 bits/s

~~(memory)~~ size = 148608000 bits

time = $\frac{148608000}{10^8 \times 4}$

$= \frac{37152\cancel{000}}{10^{\cancel{8}} \times 10^5}$

$= \boxed{0.37152 s}$

Assn 1

Q3

	clock rate	CPI
P_1	: 4.4 GHz	1.5
P_2	: 3.3 GHz	1.0
P_3	: 4.1 GHz	2.2

(a) P_1 : 4.4GHz / 1.5 = 2.93×10^9 instruction per sec

P_2 : 3.3GHz / 1 = 3.3×10^9 "

P_3 = 4.1 GHz / 2.2 = 1.86×10^9 "

$\therefore$ P2 has highest performance

(b) Cycles

P1: 4.4 GHz × 10 = 4.4×10^{10} cycles

P2: 3.3 × 10 = 3.3×10^{10} cycles

P3: 4.1 × 10 = 4.1×10^{10} "

Number of instructions

P1: 4.4 GHz * 10 / 1.5 = 2.93×10^{10} instructions

P2: 3.3 GHz × 10 / 1.0 = 3.3×10^{10} "

P3: 4.1 × 10 / 2.2 = 1.86×10^{10} "

(c) Execution time = (num of instructions × CPI) / clock rate

So, if we want to reduce execution time by 30%, CPI increases by 20%, we have

execution time × $\underbrace{0.7}_{(70\%)}$ = (No. of ins × CPI × 1.2) / new clock rate.

new clock rate = clock rate × $\frac{1.2}{0.7}$

= 1.71 × clock rate.

P1: 4.4 GHz × 1.71 = 7.524 GHz

P2: 3.3 GHz × 1.71 = 5.643 GHz

P3: 4.1 GHz × 1.71 = 7.011 GHz.

Assn 1

QC

	clock rate	CPI	execution of instruction
P1	4 GHz	0.9	5×10^9
P2	3 GHz	0.75	1.0E9 1×10^9

$$\frac{P_{P1}}{P_{P2}} = \frac{ET_{P2}}{ET_{P1}} = \frac{\dfrac{(1 \times 10^9 \text{ instructions}) \times 0.75 \text{ cycles/instr}}{3 \times 10^9}}{\dfrac{5 \times 10^9 \times 0.9}{4 \times 10^9}}$$

$$= \frac{0.75 \times 1}{5 \times 0.9} \times \frac{4}{3} = \frac{3}{13.5}$$

∴ P_1 has less performance than P_2 $\boxed{= 0.22}$

hence it's not true for P_1 & P_2

(b) $ET_{P1} = (IC_{P1} \times CPI_{P1}) / (CR_{P1})$

$= \dfrac{1.5 \times 10^9 \text{ instructions} \times 0.9 \text{ cycles/instruction}}{4 \times 10^9 \text{ cycles/sec}}$

$= \boxed{0.225\,s}$

$IC_{P2} = \dfrac{ET_{P2} \times CR_{P2}}{CPI_{P2}} = \dfrac{0.225 \times 3 \times 10^9}{0.75}$

$= \boxed{0.9 \times 10^9 \text{ instructions}}$

no. of instructions needed by P2 to execute in same time as P1

(c) MIPS = clock rate $\times 10^{-6}$ / CPI

MIPS(P1) = $4 \times 10^9 \times 10^{-6} / 0.9 = 4.44 \times 10^3$

P2 $= 3 \times 10^9 \times 10^{-6} / 0.75 = 4 \times 10^3$

MIPS(P1) > MIPS(P2) but

performance (P1) < performance (P2)

∴ not true for P1 & P_2

(d) MFLOPS = no. FP operations $\times 10^{-6}$ / ET

MFLOPS(P1) = $0.4 \times 5 \times 10^9 \times 10^{-6} / 1.125 = 1.78 \times 10^3$

(P2) = $0.4 \times 10^9 \times 10^{-6} / 0.25 = 1.6 \times 10^3$

MFLOPS(P1) > MFLOPS(P2), Performance (P1) < performance (P2)

hence not true for P_1 and P_2.

QD.

100/time with overhead

Processors	Execution time/processor	Time with overhead (+4s)	Speed up	Actual/ideal Speed up
1	100 s	54	1.85	0.925
2	50	29	3.45	1.725
4	25 s	20.67	4.84	2.42
6	16.67	16.5	6.06	3.03
8	12.5	12.33	8.11	4.055
12	8.33	10.25	9.76	4.88
16	6.25	8.167	12.24	6.12
24	4.167	7.57	13.21	6.605
28	3.57	7.125	14.036	7.018
32	3.125			
56	1.786	5.786	17.283	8.6415

64
224
448

QE

Byte addr

hex

64	1.5625	5.5625	17.978	8.989
224	0.446	4.446	22.492	11.246
448	0.223	4.223	23.68	11.84

QE) 0x134433C   0X-15EFBA4

0X134433C

Byte address	0	1	2	3 - big
hex	1	34	43	3C
	2	1	0	- low

~~0xe15e~~ 0X-15EFBA4

3	2	1	0 - low
-1	5E	FB	A4
0	1	2	3 - big

→ Linear System

Translate 0x134433C into decimal.

Q5) 134433C

$(4 \times 16^{7}) + (4 \times 16^{3}) + (3 \times 16^{2}) + (3 \times 16^{1}) + (C \times 16^{0})$

$+ (3 \times 16^{5}) + (1 \times 16^{6})$ $\Rightarrow$ $\boxed{20,202,300}$

[C = 12]

$\Rightarrow$

Q6)

	CPI	instruction breakdown
→ arithematic instructions	1	700 million
→ load / store 4	10	200 million
→ branch instructions	3	80 million

~~(700)(1) + (200 × 10) + (80 × 3)) × 10^6 × (1.1) × clock cycle = execut time~~

~~it's not a good design choice because it increases the total execution time.~~

~~(2672.72 × 10^6) / clock cycle = execution time~~

10% increase means $\frac{10x}{100} + x = \boxed{1.1x}$

* CPU time = clock cycles × clock cycle time

now, no. of clock cycles in the begining is (in millions):

$\sum_{i=1}^{3}$ no. of instructions$_i$ × CPI_i = 700×1 + 200×10 + 80×3

$= \boxed{2940}$

Therefore, the CPU time in the begining is

$CPU\ time_A = 2940 \times 10^6 \times$ clock cycle $time_A$

After decreasing the number of arithematic instructions by 25%, we have $0.75 \times 700 = 525$ million arithematic instructions.

The no. of clock cycles is now (in millions)

$(525 \times 1) + (200 \times 10) + (80 \times 3) = \boxed{2765}$

So, CPU time now is

$CPU\ time_B = 2765 \times 10^6 \times$ clock cycle $time_B$

$= 2765 \times 10^6 \times 1.1 \times$ clock cycle $time_A$

$= 3041.5 \times$ clock cycle $time_A \times 10^6$

So CPU time increase which is not good so not good design choice.

So CPU time now is,

$$CPU\ time_C = 2590 \times 10^6 \times clock\,cycle\,time_A$$

Since we do not change clock cycle time. Since

$$\frac{CPU\ time_C}{CPU\ time_A} = \frac{2590}{2940} = 0.88095$$

~~this is an increase of only 6.58%.~~

now CPI of arithematic instructions become 0.1. Thus the number of clock cycles is

$$(700 \times 0.1) + (200 \times 10) + (180 \times 3) = \underline{2310}$$

So, CPU time now is

$$CPU\ time_D = \cancel{2590}\ 2310 \times 10^6 \times clock\ cycle\ time_A$$

$$\frac{CPU\ time_D}{CPU\ time_A} = \frac{\cancel{2590}}{\cancel{2940}}\ \frac{2310}{2940} = 0.78571$$

Ass 1 (c) 10 bits for each color per pixel

3440x1440 frame size

transmit data at 144 frames per second.

$$\Rightarrow \underset{bits}{10} \times \underset{\cancel{frame}}{3440 \times 1440} \times \underset{frame/seconds}{144} = \underset{bits/second}{7133184000}$$

$$= \boxed{7133.184\ MB/s}$$

~~Module 2 Quiz~~ Assn-02

Q1. 5ED4 − 07A4

0101 1110 1101 0100

− 0000 0111 1010 0100

0101 0111 0011 0000

5 7 3 0

$\boxed{5ED4 - 07A4 = 5730}$

A81F − 5D2E

1010 1000 0001 1111

−0101 1101 0010 1110

00 0011 0001

A81F − 5D2E

1010 1000 0001 1111

0101 1101 0010 1110

~~5D2E > A81F~~

~~so, the answer is going to be negative.~~

~~0101 1101 0010 1110~~

~~−1010 1000 0001 1111~~

~~0 1 1 0101 0001 1111~~

~~1010 1000 0001 1111~~

~~0101 1101 0010 1110~~

1010 1000 0001 1111

0101 1101 0010 1110

0100 1010 1111 0001

4 10=A 15=F 1

$1+4+8+16$

$+32+2^4+$

$2^{13}+2^{15}$

$=$

$2+4+8+32$

$+2^8+2^{10}+2^{11}+$

$2^{12}+2^{14}$

$=$

Subtract to subt… Later or… the first

−0.75

$-\frac{75}{100}$ $\frac{3}{4}$

$3\times\frac{1}{4}$

$\frac{3}{2}\times\left(\frac{1}{2}\right)$

Subtraction of 2 signed binary numbers is similar to subtraction of 2 unsigned binary numbers but later on adding 2's complement of the first number.

$\frac{3}{2} \times \frac{1}{2}$ $\quad \frac{3}{4}$ $\quad \frac{\cancel{75}\,3}{\cancel{100}\,4}$

$\frac{3}{4}$ $\quad \frac{3}{2} \times \frac{1}{2}$

$2^{-4} + 2^{-2} + 2^{-1}$

$\frac{1}{8} + \frac{1}{4} + \frac{1}{2}$ $\quad 1+2+4$ $\quad \frac{7}{8}$

$\frac{75}{100}$ $\quad 0.8$

$0.25 \to \frac{1}{4}$

0.75

1 0101 101

$(-1)^1 \times (1 + .101) \times 2^{(5-7)}$

$= -1 \times 1.25 \times 2^{-2} \quad \frac{1}{4}$

$- \quad \frac{5}{4} \times \frac{1}{4}$

-0.75

$-\frac{\cancel{75}\,3}{\cancel{100}\,4}$ $\quad \left(-\frac{3}{4}\right)$ $\quad (-1)^1 \times (1.1)_2 \times 2^{(-1)}$

$3 \times \frac{1}{2}$

$3 \times \frac{1}{4}$ $\quad \frac{1}{2}$ $\quad \frac{3}{2} \to 1.5$

$\frac{3}{2} \times \left(\frac{1}{2}\right)$

$x+y$

$x = 0\ 1001\ 010$

$y = 0\ 0111\ 110$

$\boxed{x = 1.010 \times 2^{2}}$ $= 101$ $(7-7)$

$y = (-1)^0 \times (1.110) \times 2$

$= 1 \times 1.110 \times 1$

$\boxed{y = 1.110}$

$x+y = 1.010 \times 2^{2} + 1.110$

$= 101 + 1.110$

$= 110.110$

$\cancel{10100}$

$+10$

101

1.110

11.110

$= 1.010 \times 2^{2} + 0.01110 \times 2^{2}$

$= 2^{2} \times (1.010 + 0.0111)$

1.010

$+0.011$

1.101

$= \boxed{1.101 \times 2^{2}}$

Ca. $110 = 6$

101.000

1.110

110.110

$4+2+0 \cdot 0.5+0.25$

$A = a\ bcde\ fgh$

$(-1)^{a} \times 1.fgh \times 2^{(}$

$\boxed{6.75}$ (-1)

$A = 1\ 0101\ 101$

$B = 0\ 0011\ 001$

$B = (-1)^{0} \times 1.001 \times 2^{(3-7)}$

$= \boxed{1.001 \times 2^{-4}} = 0.0001001$

$A = (-1)^{1} \times 1.101 \times 2^{(5-7)}$

$= \boxed{-1.101 \times 2^{-2}} = (-0.01101)$

A+B.

$0.000\cancel{1001}$

$+ \cancel{(-0.0110100)}$

0101

$- 0.01101100$

$+ 0.0001001$

$\boxed{A+B} = -0.0101\boxed{011}$

$\boxed{1.01 \times 2^{-2}}$ decimal $= \cancel{\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \frac{1}{64} + \frac{1}{128}}$

$\cancel{(0.335937950)}$

0.01011×2^{-2}

$= \cancel{0.335}$

round up: $\boxed{0.0101}$

$\boxed{1.0101010}$

A-B

$- 0.0110100$

$- 0.0001001$

1.111 $= (-0.0111101)$

$1.1110 +7-2$

$\boxed{1.0101111}$

$A*B. = 1.001 \times 2^{-4} \times -1.101 \times 2^{-2}$

$= 1.001 \times -1.101 \times 2^{-6}$

$= \boxed{-1.110101 \times 2^{-6}} = \boxed{1\ 0001\ 110}$

1.001
$+ 1.101$

0 0 0 1 0 0 1
0 0 0 0 0 0 x
0 1 0 0 1 x x
1 0 0 1 x x x

1 1 1 0 1 0 1

$A/B = \frac{1.001}{1.101} \times 2^{-2}$

$\frac{1.101 \times 2^{-2+4}}{1.001 \times 2^{-4}}$

$= \frac{1.101 \times 2^{2}}{1.001}$

1.01
1001) 1101.
-1001
0.10000

1.0111001 100

$1001 \overline{)1101}$

1001

10000 (2)

−1001

01110

1001

1010

1001

01000

10

0000

10010

10010

$$\frac{A}{B} = 1.0111001 \times 2^{2}$$

$\boxed{1 \quad \cancel{0100} \; 1001 \quad 011}$

2+7 = 9

5ED4 = 0101 1110 1101 0100

07A4 = 0000 0111 1010 0100

0101 0111 0011 0000

5 7 3 0

for signed, the first digit is 0, thus +ve, and so the answer for signed will also be 5730.

bit pattern 0x0C000000 hex

0 0 C=12 000000

0000 1100 0000 0000 0000 0000 0000 00

~~000 1100 00 sign=0~~

~~exponent 000 1100 000 = 24~~

~~mantissa 000 0000 0000 0000 0000 0000~~

0 1100 000

$(-1)^0 \times 1.000 \times 2^{12-7}$

1.000×2^5

100000.0

⇒ 0 0001 1000 0000 0000 0000 0000 00

⇒ 0 0001 1000 0000 0000 0000 0000 0000 000

positive sign

00011000 = 24

00000000000000000000000 = 0.

$(-1)^0 \times 1.0 \times 2$

Assn 2

c) 0 × 0C000000

0000 1100 0000 0000 0000 0000 0000 0000

~ 1111 0011 1111 1111 1111 1111 1111 1111

adding 1

0 1111 0100 0000 0000 0000 0000 0000 0000

2's complement

$2^{31} + 2^{30} + 2^{29} + 2^{28} + 2^{26}$ = ~~4,093,640,704~~

= $\boxed{+201326592}$

268B300C

0010 0100 1000 1011 0011 0000 0000 1100

1101 1011 0111 0100 1100 1111 1111 0011

+1

1101 1011 0111 0100 1100 1111 1111 0100

11111001

11111010

00000000

1111001X

000000XX

11001XXX

1001XXXX

001XXXXX

01XXXXXX

1XXXXXXX

00101010

Q Assn 2 F

31.625 to 32

31 to binary 11111

0.625 to binary

0.625 × 2 = 1.250 = 1 + 0.25

0.25 × 2 = 0.5 = 0 + 0.5

0.5 × 2 = 1.0 = 1

0.101

$(31.25)_{10} = (11111.101)_2$

$= 11111.101 \times 2^0$

$= 1.1111101 \times 2^4$

sign = 0 (positive no.)

exponent = 4 (unadjusted).

mantissa = 1.1111101

exponent (adjusted) = 4 + α − 1   127

= 4 + 127

$= (131)_{10}$

$= (10000011)_2$

mantissa (normalized) = 1111101000000000000000000

28 bits

⇒ $\boxed{0}$ $\boxed{10000011}$ 111 1101 0000 0000 0000 0000

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16, 8, 4, 2, 1

24 + 4 = 28

~~8×8~~ $((i \times size) + i) \times 4$ + base address

Assn 4

$\$a0 \rightarrow$ matrix A
$\$a1 \rightarrow$ matrix B
$\$a3 \rightarrow$ size $= 4$
$\$a2 \rightarrow$ matrix C

$\$t0 = i$
$\$t1 = j$
~~$\$t2 = size * 4$~~
~~$= \$a2 * 4$~~

$\$t3 = i \times 16$
~~$\$t4 = j \times 4$~~

address ~~$\$t5 = \$t3 + \$t4$~~
~~$\$t5 = \$t5 + \$a0$~~
~~$\$t6 = \$t3 + \$t4$~~
~~$\$t5 + \$a1$~~

~~$\$t7 = (\$a0, (\$t5) + \$a1 (\$t6))$~~

while (~~$j \neq 3$~~ $j \leq 3$)

address $= i * (4 \times 4) + j \times 4$
$[(i \times 4) + j] \times 4$

~~+ base address~~

Sum $= A[i,j] + B[i,j]$

$\$t5 = \$t0 \times \$a2$
$\$t5 = \$t5 + \$t1$
$\$t5 = \$t5 \times 4$
$\$t6 = \$t5 + \$a0$
$\$t7 = \$t5 + \$a1$
$\$t8 = \$$ ~~$a0$~~ $t6$ + ~~$\$a1$~~ $t7$
~~$\$t9 = \$t5 + \$a2$~~

sum

~~$\$t$~~

$(a_{11} \times a_{11}) + (a_{12} \times a_{21})$
$+ (a_{13} \times a_{31})$

$i = 1$

→ Linear Search

matrix multiplication

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~~while~~(int product = 0;

for(i = 0 ; i < 4 ; i++)
for(j = 0 ; j < 4 ; j++)
{ A[i, j] * B[j, i] = product ;
~~product = product + ;~~
product += ; → $V1
}

$t0 = i
$t1 = j

$a0 → matrix A
$a1 → matrix B
$a3 → size

A[i,j] = [((i * size) + j] * 4
B[j,i] = [(j * size) + i] * 4

loop:
j < 4
i = 0
A[i, j] → $t6
B[i, j] → $t7
product = A[i, j] * B[i, j] → $t2
sumofproducts = sumofproducts + product
j++

i++

$$\begin{pmatrix} 2 & 1 & 9 & 2 \\ 7 & 9 & 10 & 10 \\ 3 & 4 & 3 & 4 \\ 2 & 5 & 4 & 6 \end{pmatrix} \begin{pmatrix} 8 & 7 & 1 & 2 \\ 2 & 7 & 3 & 6 \\ 7 & 5 & 6 & 8 \\ 9 & 4 & 8 & 9 \end{pmatrix}$$

transpose

$A[i,j] = A'[i,j]$.

$$\begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix} \qquad \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

A   A'

1 ' ' 2 ' ' 3 ' ' 4

\n 5 ' ' 6 ' ' 7 ' ' 8 ' '

\n

$t9 → index through matrix C.

columncount → $t2

rowcount → $t3

t1   (t3, t1)

$$t0 \begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ \vdots & \vdots & \vdots & \vdots \end{pmatrix} \quad \begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ \vdots & \vdots & \vdots & \vdots \end{pmatrix}$$

~~(t0, t1)~~

(t3, t1)

t0 = 0 → t0 = 1

t3 = 0 $t1 = 0, 1, 2, 3, \boxed{4}$ $(t0, t1) \times (t1, t3)$

t0 = 0   t3 = 1 $t1 = 0, 1, 2, 3, \boxed{4}$

t1 = 0

t0 = 0   t3 = 2

t3 = 4

16+2+63+18	14+7+45+8	2+3+54+16
56+18+70+90	49+63+50+4	7+27+60+80
24+8+21+36	21+28+15+16	3+12+18+32
16+10+28+54	14+35+20+24	2+15+24+48
4+6+72+18		
14+54+80+90		
6+24+24+36		
4+30+32+54		

→ Linear System:

Address	$(A/32)\%32$ $B\%32$ Index cache Block	$(A/32)/32$ address in binary Tag	A/32 block no		
0	00000	000000	0	0-31	miss
4	00000	0000	0	0-31	hit
16	00000	0000	0	0-31	hit
132	4 00100	0000	4	128-159	miss
232	7 00111	0000	7	224-255	miss
160	5 00101	0000	5	160-191	miss
1024	32 00000	0001	32	1024-1055	miss
30	0 00000	0000	0	0-31	miss
140	4 00100	$B/32$ 0000	4	128-159	hit
A 3100	0 00000	0011	96	3072-3103	miss
180	5 00101	0000	5	160-191	hit
B 2180	4 00100	0010	68	2176-2207	miss

cache Block

$4/32$ $\quad$ $7/32$ $\quad$ $5/32$

32) 132 (4
128
4

32) 232 (7
224
8

32) 160 (5
160
0

32) 1024 (32/32
96
64
64
0

32) 140 (4
128

32) 3100 (96
288
220
216
= 3

96
32) 96 (3
96
0

32) 180 (5
160
20

32) 2180 (68
192
260
256
4

32) 68 (2
64
4

Address	Index	address in binary	Bno.		
3505	01101	0011	109	miss	32
185	00101	0000	5	~~hit~~ hit	64
869	11011	0000	27	miss	96
7041	11100	0110	220	miss	128

160
192
224
256
288
320
352

32) 3505 (109
32
305
288

32) 109 (3
96
13

32) 185 (5
160
25

32) 869 (27
64
229
229
3

32) 7041 (220
64
64
64
01

32) 220 (6
192
28

$\overbrace{00000}^{5}$ $\overbrace{00000}^{5}$

0000000000000 : 00000 00000 = 32 miss

22

	Index	Offset	
0			
4	00000	00100	hit
16	00000	10000	hit
132	00100	00100	miss
232	00111	01000	~~hat~~ miss

128 64 32
16 8 4 2 1

128 + 64 = 132

128 + 64 + 32 = 224, 8

128 + 32 = 160

136 + 4 = 140

1024 + 1024 = 2048
2048 + 256 + 128 = 2432
2432 + 32 = 2464

128 + 128 = 256
256 + 2164 + 16 = 2480
2480 + 1024 = 2504

6 b A B

1 1100 010 − 1 1001 011

$A = 1\ \boxed{1100}\ 010$ 12 − 7 → bias

$= (-1)^1 \times 1.010 \times 2^5$

$= -1.010 \times 2^5$

$= -101000.$

$B = 1\ 1001\ 011$ 9 − 7

$= (-1)^1 \times 1.011 \times 2$

$= -1.011 \times 2^2$

$= -101.1$

A − B

$-101000.0 - (-101.1)$

$-101000.0 + 101.1$

-101000.0

$+ 101.1$

-100010.1

$-1\ 00010.1$

+5 + 7 = 12

$\boxed{1\ \ 1100\ \ 000}$

Computer networking

C#, Java, SQL, Python,

14400

1400

→ Linear Systems.

(a) 0 1100 001 + 0 1011

$A = 0\ 1100\ 001$

$= (-1)^0 \times 1.001 \times 2^{12-7}$

$= 1.001 \times 2^5$

$= 100100$

$B = (-1)^0 \times 1.010 \times 2^{11-7}$

$= 1.010 \times 2^4$

$= 10100$

$$
\begin{array}{r}
100100 \\
10100 \\
\hline
+\ 111000 \\
\hline
\end{array}
$$

$+5 + 7 = 12$

$= 1.110$

$\boxed{0 \quad 1100 \quad 110}$

(c) 1 0011 100 * 0 1100 010

$A = 1\ 0011\ 100$

$= (-1)^1 \times 1.100 \times 2^{3-7}$

$= -1.100 \times 2^{-4}$

$\cancel{= -0.00011}$

$B = 0\ 1100\ 010$

$= (-1)^0 \times 1.010 \times 2^{12-7}$

$= 1.010 \times 2^5$

$-1.100 \times 2^{-4} \times 1.010 \times 2^5$

$= -1.100 \times 1.010 \times 2^{-4+5}$

$= -1.100 \times 1.010 \times 2^{(1)}$

$$\begin{array}{r} 1.100 \\ \times\ 1.010 \\ \hline 0000\ 0000 \\ 0011\ 00\times \\ 0000\ 0\times\times \\ 1100\ \times\times\times \\ \hline 1.1111000 \end{array}$$

1.111×2^{1}

$1 + 7 = 8$

$\cancel{0\ 0000}$

$\boxed{1\ 1000\ 111}$

$1.111 \times 2^{8-7}$

(d) 0 1011 011 / 0 0111 011

$A = 0\ 1011\ 011$

$= (-1)^0 \times 1.011 \times 2^{11-7}$

$= 1.011 \times 2^4$

$B = (-1)^0 \times 1.011 \times 2^{7-7}$

$= 1.011 \times 2^0$

$$\frac{1.0\cancel{11} \times 2^4}{\cancel{1.011 \times 2^0}}$$

$= 2^4 \times 1.000$

$4 + 7 = 11$

$\cancel{0\ 0000}$

$\boxed{0\ 1011\ 000}$

(e) 0 1100 001

$(-1)^0 \times 1.001 \times 2^{12-7}$

$= 1.001 \times 2^5$

$= 100100$

32 16 8 4 2 1

Ans: $\boxed{36}$

-0.75 → binary → floating point number

Q6 (a) 0 1100 001 + 0 1011 010

$A = 0\ \underbrace{1100}_{12}\ 001$ $(12-7)$

$= (-1)^0 \times 1.001 \times 2^{(12-7)}$

$= 1.001 \times 2^5$

$= 100100$

$B = 0\ \underbrace{1011}_{11}\ 010$

$= (-1)^0 \times 1.010 \times 2^{(11-7)}$

$= 1.010 \times 2^4$

$= 10100$

$A+B = $

$$\begin{array}{r} 100100.0 \\ 10100.0 \\ \hline 111000.0 \end{array}$$

+5

$+5+7=12$

$11000.0 \times 2^{-5} = 1.1100$

$\boxed{A+B = 0\ 1100\ 110}$

(b) 1 1100 010 − 1 1001 011

$A = 1\ \overbrace{1100}^{12}\ 010 \quad (12-7)$

$= (-1)^1 \times 1.010 \times 2$

$= -1.010 \times 2^5$

$= -101000.0$

$B = 1\ \overbrace{1001}^{9}\ 011$

$= (-1)^1 \times 1.011 \times 2^{(9-7)}$

$= -1.011 \times 2^2$

$= -101.1$

$A - B$

$-101000.0 - (-101.1)$

$= -101000 + 101.10$

~~101000.0~~

$$\begin{array}{r} -100\cancel{1}\cancel{0}\cancel{0}\cancel{0}.\cancel{0}\,2 \\ +\quad 101.1 \\ \hline -100010.1 \end{array}$$

$+5$

$+5+7=12$

$A - B = -1.001 \times 2^{+5}$

$\boxed{A-B = 1\ 1100\ 001}$

add $s0, $t0, $t1
sub $t2, $s0, $t3
beq $t2, $s3, LBL ~~Ifnotequal~~
add $s4, $t2, 1
LBL:
mul $s4 $t2 2

	IF	ID	EX	MEM	WB
case1	20	15	20	20	15
case 2	25	5	30	10	20

(a) ET?
(b) hazards, MEM, ET?

Case 1	1	2	3	4	5	6	7	8	9
add	IF	ID	EX	mEm	WB				
sub		IF	ID	EX	mem	WB			
beq			IF	ID	EX	mem	WB		
add				IF	ID	EX	mem	WB	
	20	20	20	20	20	20	20	15	

total time = $\boxed{155}$

Case 2	25	25	30	30	30	30	20	20	$\boxed{210}$

~~5.4105453~~

12.375

C.6

128 + 6

134

128 64 32 16

~~128 64 32~~ 8 4 2 1

0 1000 0010 1.00011000000000000000000000

128 + 8 4 2 1

1000 0110

$(-1)^0 \times 1. \times 2^{-(E-bias)}$

$2^{-(130-127)}$

$(-1)^0 \times 1.523 \times 2^{-3}$

1. 1000011

-1 -2 -3 -4 -5 -6 -7

$1 + \left(\frac{1}{2} + \frac{1}{2^6} + \frac{1}{2^7}\right)$

$+1.523 \times 2^{-3}$

+0.125

$2^{-1} + 2^{-6} + 2^{-7}$

+12.375

S = 0

12 to binary

12/2 = 6 + 0

6/2 = 3 + 0

3/2 = 1 1

1/2 = 0 1

$12 \rightarrow (1100)_2$

0.375 to binary

0.375 × 2 = 0.750 0

0.75 × 2 = 1.50 1

0.5 × 2 = 1.00 1

$(0.011)_2$

$\boxed{(12.375)_{10} = (1100.011)_2}$

make 1 non zero digit to left of decimal point

1.100011×2^{3} 3 exp

S → 0

E → 3 → add bias 127   3 + 127 = 130 - convert to binary

E = $(1000\ 0010)_2$

F → mantissa

remove the 1 before decimal pt   100011 → make it 23 bits by adding 0 to right

F = 10001100000000000000000

$(-1)^0 \times 1.100011 \times 2^{-(130-127)}$

$\boxed{(-1)^0 \times 1.100011 \times 2^{-3}}$

$+\ 1.100011 \times 2^{-3}$