Fall 2023 CSE340 Online ~~Midterm~~ Final Exam.

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Sec : 08

Set : ~~A~~ B

Ans to the Q. No - 1

(a) Given,

$X = 2.021$

$Y = 0.91$

$2 \rightarrow 10$

$0.021 \rightarrow 0.00000010$

$2.021 \rightarrow 10.00000010$

$\therefore X \text{ in (Bin)} = 10.00000010$

$\therefore X \text{ in (Norm)} = 1.00000010 \times 2^1$

$\therefore Y \text{ in (Bin)} = 0.1110100$

$\therefore Y \text{ in (Norm)} = 1.110100 \times 2^{-1}$

$\therefore (X * Y) = (1.00000010 \times 2^1) * (1.110100 \times 2^{-1})$

$= (1.00000010 * 1.110100) * 2^{0}$

$= 1.11010110100 \times 2^0$

$= 1.(2^{-1} + 2^{-2} + 2^{-4} + 2^{-6} + 2^{-7} + 2^{-9} + 2^{-10})$

1(b) Given,

20 bit → 1, 5, 14

$X = -61.312$

X in (Bin) = $1111101.0100111111011111101$

X in (Norm) = $1.1111010100111111011111101 \times 2^5$

Here,

sign bit = 1 (neg)

Exponent = 5

$\therefore$ bias $= (2^{n-1} - 1)$

$= (2^4 - 1)$

$= 15$

$\therefore$ biased exponent $= (5+15) = 20$

$= 10100$

$\therefore$ Fraction = 0.11110100111111

$\therefore$ Floating Point = $0\ 10100\ 11110100111111$ $\times 2^{20}$ (Ans)

~~Floating point = 0~~

∴ In IEEE format,

$$\underbrace{1}_{\bullet}\ \underbrace{10100}_{\bullet}\ \underbrace{11101010011111}_{\bullet}$$

in Hex $= \left(\underbrace{1101}_{D}\ \underbrace{0011}_{3}\ \underbrace{1010}_{A}\ \underbrace{1001}_{9}\ \underbrace{1111}_{F}\right)_2$

$= 0xD3A9F$ (Ans.)

1. (c) Given,

$X = 7AAC2000$

$Y = 2BCDC000$

X in (Bin) $= \underbrace{0}_{1}\ \underbrace{111\ 1010}_{8}\ \underbrace{1010\ 1100\ 0010\ 0000\ 0000\ 000}_{23}$

Y in (Bin) $= \underbrace{0010\ 1011}_{8}\ \underbrace{1100\ 1101\ 1100\ 0000\ 0000\ 0000}_{23}$

for X,

sign bit $= 0$

biased exponent $= 11110101$

$= 245$

∴ exponent $= (245 - 127)$

$= 118$

∴ Fraction $= 01011000010000000000000$

$\therefore X \text{ in (Norm)} = 1.0101100000010000000000000 \times 2^{118}$

11 100

13

for Y,

sign bit = 0

biased exponent = 01010111

= 87

$\therefore$ exponent = (87 − 127) = −40

Fraction = 0.10011011100 0000000000000

$\therefore Y \text{ in (Norm)} = 1.10011011100\,0000000000000 \times 2^{-40}$

Now, $= 0.[158\ 0,5]$

(X + Y)

$= 0.[158\ 0,5]10011011100\,0000000000000 \times 2^{118}$

19 13

Now,

$(X+Y) = 10.[158\ 0,5]$ $10011101111\,0000000000000 \times 2^{118}$

13

$\therefore (X+Y) = 1.[158\ 0,5]10011101111\,0000000000000 \times 2^{118}$

$= 1\,[118\ 0,5].[40\ 0,5]10011011100\,0000000000 \times 2^{0}$ (Ans)

$= 0$ (dec) (Ans)

Ans to Que No-2

2.(a) (i) direct addressing like I-type.

(ii) Registers addressing like R-type.

(iii) Memory addressing like load or storing something.

2.(b) (i)

```
lw $t0, 28($s4)
sll $t1, $t0, 2
add $t1, $s0,
```

A → $s0

F → $s4

i → $s1

n → $s2

2.(b)

(i) lw $t0, 8($s0)

lw $t1, 28($s4)

sll $t1, $t1, 2

add $t1, $t1, $s4

lw $t2, 0($t1)

bne $t0, $t2, L1

lw $t3, 12($s0) ⟶ t3 = A(3)

lw $t4, 8($s0) → t4 = A(2)

sll $t2, $t3, 3 → (8A)

sll $t6, $t3, 1 → (2A)

add $t5, $t5, $t6 → (10A)

add $t5, $t5, $t3 → (11A)

L1 :

2.(b)

~~(i) add $t0, $s1, $zero~~

(ii)

```
add $s1, $zero, $zero
slt $t0, $s1, $s2
beq $t0, $zero, L1
Loop:
    sll $t0, $s1, 2
    add $t0, $t0, $s0
    sll $t0, $t0, 2
    lw $t1, 0($t0)
    sll $t2, $t3, 4
    ~~sub $t2, $t2, $t1~~
    ~~sub $t2, $t2, $t1~~
    ~~sll $t2, $~~
    j Loop
L1:
```

Ans to the Q. No-3

3.(a) Given,

mem op = 65ps

reg op = 33 ps

com op = 52ps

for lw,

IF = 65 ps
ID = 33 ps
EX = 52 ps
MEM = 65 ps
WB = 33ps

} total time = 248 ps

for sw,

IF = 65 ps
ID = 33 ps
EX = 52ps
MEM = 65ps
WB = 0ps

} total = 215 ps

∴ to complete a lw and a sw the total time in single cycle = (248+248) = 496 ps Ans.

~~also, in pipeline the total time = (65×5) + 65×~~

also, in pipeline the total time = 390 ps

(Ans.)

3.(b)

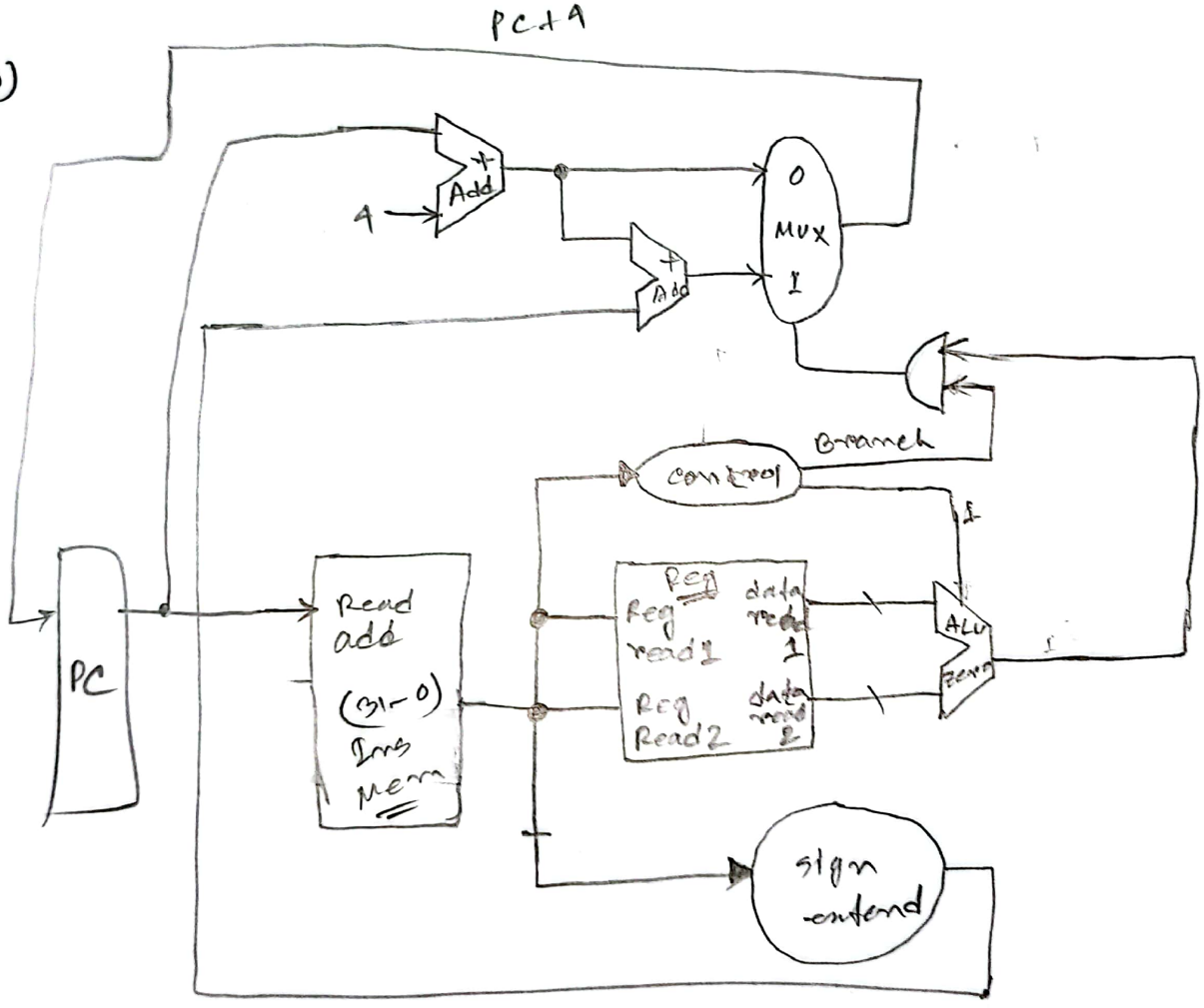


Fig: Bne datapath

3. (c)

(i) Double data hazard means when two sequential instructions depend on the result of their previous instruction.

for example,

```
add $t0, $s1, $s2
sub $t1, $t0, $s3
sub $t3, $t0, $s6
```

here, for $t0 reg, the double data hazard occured.

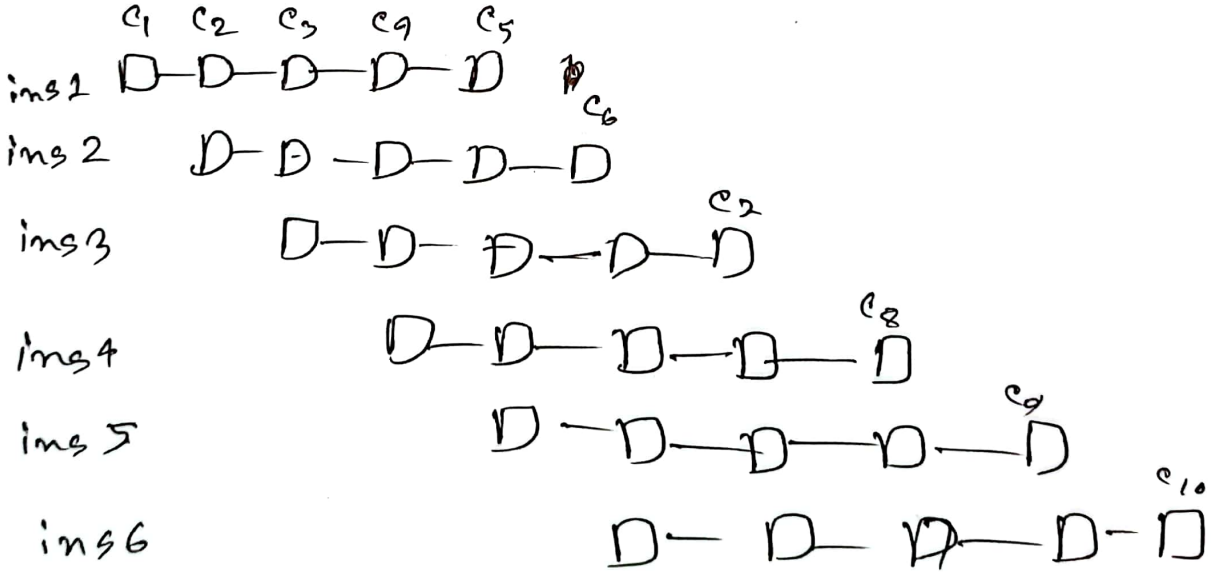
(ii) To overcome the hazard we can revise the forwarding condition or code scheduling.

3. (c)

(ii) In mem op ~~is~~, pipeline system can fetch and decode whether the instruction is instruction is a mem write or read. It can understand by seeing the op code ~~in~~ in the fetching and decoding stage. Also, the control unit send the signal if it is a mem read or a mem write operation.

3. (d)

(i)



$$\therefore CPI = \frac{10}{6} = 1.667 \quad \text{(Ans.)}$$

again,

total time = (65×10) ps

= 650 ps

Ans)

3. (d)

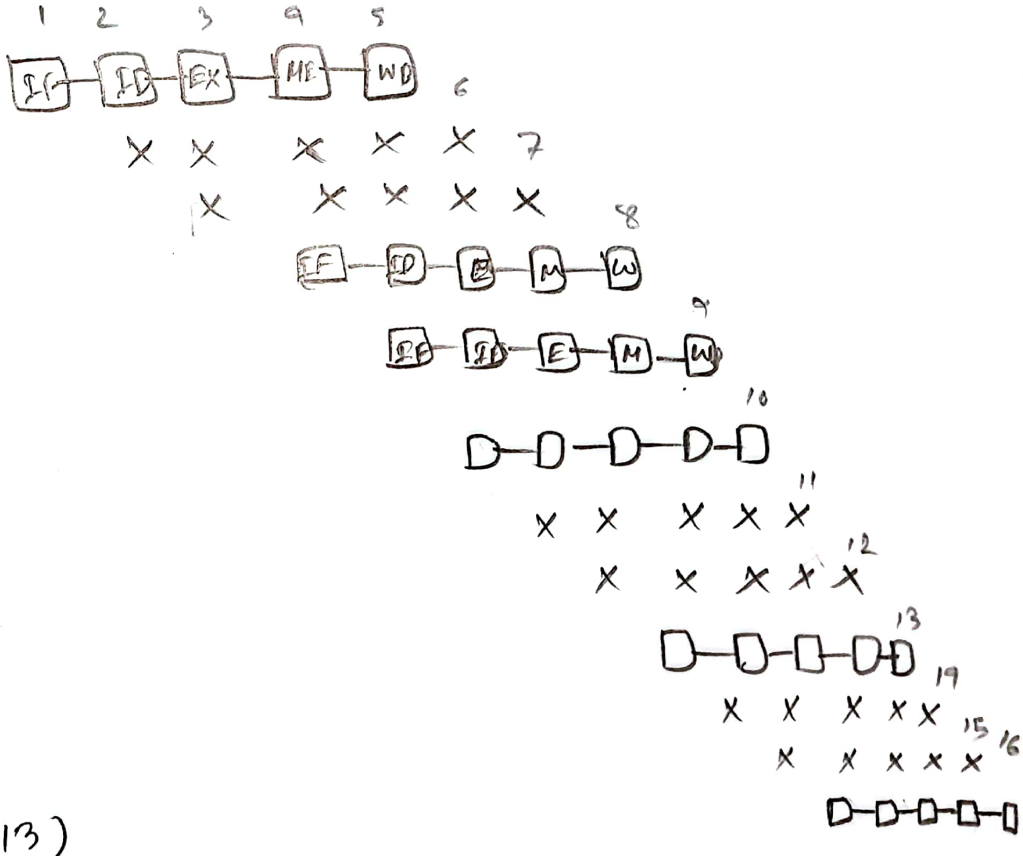
(ii) there are three data hazards.

Ans)

3. (d)

(iii)

lw $10, 40($11)



add $5, $10, $7

sub $3, $7, $9

sll $5, $5, 3

lw $13, 48($5)

lw $13, 32($13)

$\therefore CPI = \frac{16}{6} = 2.667$ Ans).

also, total time = (65 × 16) = 1040 ps

Ans)

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