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Fall 2023 CSE340 Online Midterm  
Exam

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Section : 09

Question Set: A

## Answer to the question no 1

(a)

Elapsed time: Elapsed time and CPU time are the same time. Elapsed time is the total time taken by a computer to execute a program.

CPU time:

CPU time is the total time taken by a computer to execute a program.

(b)

The power trend equation states that,

$$P = \text{Capacitive load} \times \text{Voltage}^2 \times \text{Frequency}$$

$$\therefore \frac{P_{\text{new}}}{P_{\text{old}}} = \frac{0.88 C \times (0.79 V)^2 \times 0.79 F}{C \times V^2 \times F}$$

$$= 0.43387432.$$

~~$$\therefore (1 - 0.43387432) = 56.612$$~~

$\therefore (1 - 0.43387432) \times 100\% = 56.612\%$  can be reduced in the new system compared to the old system

(c)

Given that

$$\text{Total time, } T = 120 \text{ s}$$

$$\begin{aligned}\therefore T_{\text{affected}} &= 120 \times (100 - 17)\% \text{ s} \\ &= 120 \times 83\% \text{ s} \\ &= 99.6 \text{ s}\end{aligned}$$

$$\therefore T_{\text{unaffected}} = 20.4.$$

we want to improve the performance by 2.56 times

$$\therefore T_{\text{improved}} = \frac{T}{2.56} = \frac{120}{2.56} = 46.875$$

improving factor,  $n = ?$

According to Ampel's law

$$T_{\text{improved}} = \frac{T_{\text{affected}}}{n} + T_{\text{unaffected}}$$

$$\Rightarrow 46.875 = \frac{99.6}{n} + 20.4$$

$$\Rightarrow \frac{99.6}{n} = 46.875 - 20.4$$

$$\Rightarrow \frac{99.6}{n} = 26.475$$

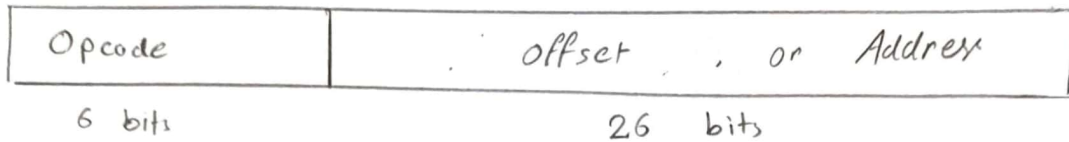
$$\Rightarrow n = 3.76203$$

$\therefore$  So to improve our overall performance

by 2.56 times; we have to improve our Taffected  
time by 3.762 times. ~~Then, our~~ To achieve  
our goal our time taken by parallel operation  
should be, 26.475 seconds.

(a)

Instruction format for j type instruction is as follows



There is no need of ALU or adder in case of jump address calculation. Because, while we calculate the jump address we

first 2 bit left shift our 26 bit offset on address. Then we get 28 bit address representation of our offset address.

Still 4 bits are left for 32 bit address. and for that left out 4 bits we ~~can~~ we our PC's first

4 MSB bit. Therefore, we ~~can~~ don't need ALU or adder in jump address calculation.

Our given j type instruction is,

JAL 120

and PC's address is  $= (0 \times 00000000)_{16}$

$\therefore$  PC's address in binary would be

$$= (0000 \ 0000 \ 0000 \ 0000 \ 0000 \ 0000 \ 0000 \ 0000)_2$$

$\therefore$  offset in  $(120)_{10}$

$\therefore$  offset in 26 bit binary  ~~$= 00000000$~~

$$= 00 \ 0000 \ 0000 \ 0000 \ 0000 \ 0111 \ 1000$$

$\therefore$  offset after 2 bit left shift; so 28 bit

representation of offset

$$= 00 \ 0000 \ 0000 \ 0000 \ 0000 \ 0111 \ 1000 \ 00$$

$\therefore$  Jump address = (PC's 4 MSB bits): (28 bit rep. of offset)

$$= 0000; 00 \ 0000 \ 0000 \ 0000 \ 0000 \ 0111 \ 1000 \ 00$$

$$= 0000.00.0000.0000.0000.0000 \ 0111 \ 1000 \ 00$$

$$= (000001E0)_{16}$$

$\therefore$  Jump address  $0 \times 000001E0$ .

i type instruction format for the given mips code would be



(b)

Assuming that PC holds the address

add \$5, \$6, \$9 // \$S5 = 12 + 4 = 16

sll \$5, \$5, 3 // \$S5 = 128,

srl \$5, \$5, 2 // \$S5 = 32

~~sw \$S5, 40(\$S6) // \$S5 = 172~~

sw \$S5, 40(\$S6) # \$S5 = 32; address = 12 + (40x4)  
= 172.

(c)

lui \$4, 1234

ori \$4, \$4, 5678

(d)

Given, MIPS code is,

$$A[3] = 12 \times X - 7 * A[5] + 33 * Y - 70 ;$$

Base address of  $A = \$50,$

$X = \$s1.$

$Y = \$s2$

MIPS Code:

lw \$t0, 20(\$50)

sll \$t1, \$t0, 3

sub \$t1, \$t1, \$t0 #  $7 * A[5]$

sll \$t0, \$s1, 3 #  $8X$

add \$t0, \$s1, \$t0

add \$t0, \$s1, \$t0

add \$t0, \$s1, \$t0

add \$t0, \$s1, \$t0 #  $12X$

sub \$t0, \$t0, \$t1 #  $(12X - 7A[5])$



sl \$t1, \$s2, 5

add \$t1, \$s2, \$t1, # 33Y

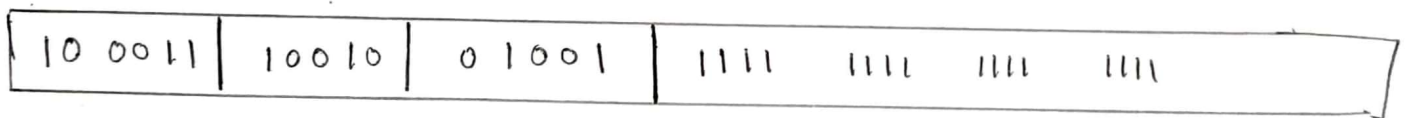
add \$to, \$to, \$t1, # (12x - 7A[5] + 33Y)

addi \$to, \$to, -70

sw \$to, 12 (\$s0)

(e)

addi \$9, \$18, -1



∴ Machine Code's Corresponding Hex would be

= (1000.11. 100.10. 0.100.1. 1111 1111 1111 1111)

= 8E 49 FFFF