BRAC UNIVERSITY
Department of Computer Science and Engineering

Examination: Quiz - 1
Duration: 30 minutes

Semester: Fall 2024
Full Marks: 15

CSE 340: Computer Architecture

Name: Solution	ID:	Section: 06

1. Given that Computer has a MIPS of 5, and it requires 5 seconds to execute a specific program, CPI is 2. **Determine** the number of total clock cycles for that program. [2]

Answer: MIPS = 5; 5M instructions run in 1s.

1s → 5M ins

5s → (5×5)M ins.
= 25M ins.

Clock Cycle = Instruction Count × CPI
= 25M × 2
= 50M = 50,000000 (Ans)

2. Processor A has a clock cycle time of 4ns, average CPI of 0.7. P2 has a clock cycle time of 3.5ns, an average CPI of 0.7. Both of the computers have the same ISA. + Same Prog. → Ic same. **Determine** which computer is faster and by **how** much? [3+2]

Answer: While comparing, you must use the same program in both computers.

CPU time$_A$ = Ic × 0.7 × 4
= 2.8 Ic ns

CPU time$_B$ = Ic × 0.7 × 3.5 ns
= 2.45 Ic ns

$$\frac{\text{CPU time}_A}{\text{CPU time}_B} = \frac{2.8\,Ic}{2.45\,Ic}$$

$$= 1.1428$$

CPU time$_A$ = 1.1428 × CPU time$_B$

So, Compute B is 1.14 times faster than Computer A.

3. Suppose you are developing a new machine learning system where it takes 25s to complete a given task. This system heavily depends on text processing, which takes 67% of the total time. What will be the improvement factor of text processing if you want to reduce the execution time to 12.4s? [3] → n?

Answer: $T_{old} = 25s$

$T_{text\ Processing} = (25 \times 0.67) = 16.75s$ → Time affected

$T_{new} = 12.4s$

∴ Time unaffected = (25 − 16.75)
= 8.25s

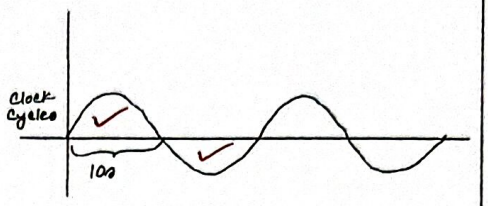
$$\Rightarrow T_{new} = \frac{T_{affected}}{n} + T_{unaffected}$$

$$\Rightarrow 12.4 = \frac{16.75}{n} + 8.25$$

$$\Rightarrow \frac{16.75}{n} = 4.15$$

$$\Rightarrow n = 4.036 \quad (Ans)$$

4.

ADD X_{20}, X_{21}, X_{22} — 1 ADD X_{20}, X_{21}, X_{21} — 2 SUB X_{20}, X_{21}, X_{22} — 3 SUB X_{20}, X_{21}, X_{22} — 4 ADD X_{20}, X_{21}, X_{22} — 5 ADD X_{20}, X_{21}, X_{22} — 6 LD X_{20}, 10(X_{21}) — 7 ADD X_{20}, X_{21}, X_{22} — 8 SD X_{21}, 10(X_{20}) — 9	

CPI for Add, Sub, LD, SD instructions are 3, 2, 4, 5.

a. Find the number of instructions in the above code. [1] — 9
b. Find the average CPI. [1]
c. Find the clock cycle time. [1]
d. Find the time to execute this program. [2]

a) 9 instructions

b)

Ins	Add	Sub	LD	SD
CPI	3	2	4	5
I.C	5	2	1	1

$$\text{Average C.P.I} = \frac{(3\times5)+(2\times2)+(4\times1)+(5\times1)}{9}$$

$$= 3.11$$

c) Clock Cycle Time = Time taken to complete 1 clock

$$= (10 + 10) = 20n.$$

d) CPU time = $9 \times 3.11 \times 20$

$$= 560n.$$