



ACADEMY FOR SCIENCE & TECHNOLOGY
COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Computer Engineering Department

Course : Computer Architecture

Course Code: CC 311

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Sheet #2

- 1) We wish to compare the performance of two different computers M1 and M2. The following measurements have been made on these computers:

Program	Time on M1	Time on M2
1	2.0 s	1.5 s
2	5.0 s	10.0 s

- i) Which computer is faster for each program?

Program	Instructions executed on M1	Instructions executed on M2
1	5×10^9	6×10^9

- ii) Find the instruction execution rate (instructions per second) for each computer when running program 1.

- 2) Consider two different implementations P1 and P2 of the same instruction set. There are five classes of instructions A,B,C,D and E in the instruction set. P1 has a clock rate of 4 GHz. P2 has a clock rate of 6 GHz. The average number of cycles for each instruction class for P1 and P2 as follows:

Class	CPI on P1	CPI on P2
A	1	2
B	2	2
C	3	2
D	4	4
E	3	4

- Calculate the performance of P1 and P2 that expressed in instructions per second.
- 3) Consider two different implementations M1 and M2 of the same instruction set. There are three classes of instructions A, B and C in the instruction set. M1 has a clock rate of 6 GHz and M2 has a clock rate of 3 GHz. The average number of cycles for each instruction class on M1 and M2 is given in the following table:

Class	CPI on M1	CPI on M2	C1 Usage	C2 Usage
A	2	1	40%	40%
B	3	2	40%	20%
C	5	2	20%	40%

C1 is a compiler produced by the makers of M1, C2 is a compiler produced by the makers of M2. Assume that each compiler uses the same number of instructions for a given program but that the instruction mix is as described in the table.

- Using C1 on both M1 and M2, how much faster is M1 than M2?
- Using C2 on both M1 and M2, how much faster is M1 than M2?
- If you purchased M1 which compiler would you use?
- If you purchased M2 which compiler would you use?

4) Consider the following code:

```

Add $t1,$zero,$zero
Addi $t0,$zero,0
Addi $s0,$zero,0
Addi $s0,$zero,5
Loop: Add $t1,$t1,$t0
      Addi $t0,$t0,1
      Bne $t0,$s0,loop

```

Class	CPI
R-type	3
I-type	4
J-type	2

- Calculate the CPU clock cycles
- If the clock rates is 4GHz , calculate the CPU execution time.

5) Given the following CPI for the MIPS instructions:

Class	CPI	Usage
Lw	5	10%
Sw	4	12%
J, beq	3	15%
Mul	10	5%
R- type	4	30%
addf	8	20%
Jump far	4	8%

- What is the average CPI, execution time, MIPS of the above program given the clock rate 20 Mhz and the program length 5 million instruction.