



No E-Mail submissions will be accepted.

Submission formats and file naming:

File name : firstName_lastName_lab_

File format: pdf or MS Word format

e.g. Donald_Trump_lab_.pdf

Reading materials

Use the following link and write a one page summary about the movie.

How Does a Quantum Computer Work?

https://www.youtube.com/watch?v=g_IaVepNDT4&ab_channel=Veritasium



1) The state of 8088 CPU at certain time is given by the following figure. Using this figure obtain next instruction, machine code, and the value of AX, CX, and BX before and after CPU execution.

```
AX=0100  BX=0023  CX=0123  DX=0000  SP=FFEE  BP=0000  SI=0000  DI=0000
DS=11B4  ES=11B4  SS=11B4  CS=11B4  IP=0300  NU UP EI PL NZ NA PO NC
11B4:0300 01C8          ADD     AX,CX
```

```
AX=0223  BX=0023  CX=0123  DX=0000  SP=FFEE  BP=0000  SI=0000  DI=0000
DS=11B4  ES=11B4  SS=11B4  CS=11B4  IP=0302  NU UP EI PL NZ NA PO NC
11B4:0302 2020          AND     [BX+SI],AH
```

2) A program consists of 8 floating point instructions and 12 integer instructions. Floating point instructions take 5 cycles and integer instructions take 2 cycles each. Assuming that the processor has a clock rate of 200.0 MHz:

- Obtain the total cycles. $8 \times 5 + 12 \times 2 = 64$
- Obtain the total instructions. $8 + 12 = 20$
- Obtain the average cycles per instruction. $64/20 = 3.2$
- Using the total cycles Obtain the execution time. $64 \times (1/200 \times 10^6) \times 10^9 = 320 \text{ nsec}$
- Using the average cycles per instruction obtain the execution time.
 $20 \times 3.2 \times (1/200 \times 10^6) \times 10^9 = 320 \text{ nsec}$
- Compare the results obtained in parts e and d. Both has same execution time

3) A program consists of 50,000 instructions as follows:

Instruction Type	Instruction Count(IC)	Cycle per Instruction(CPI)
Floating point	30,000	5
Integer	16,000	2
Data transfer	4,000	6

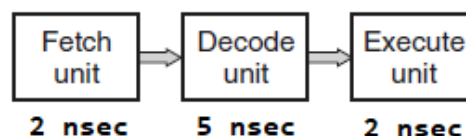
❖ Complete the following table:

Processor	Clock Rate (MHz)	Cycle Time(CT) (nanosecond)	Execution Time (microsecond)
P1	200	5	1030
P2	300	3.3	679.8
P3	500	2	412

❖ Obtain the average cycles per instruction.

$$(30000 \times 5 + 16000 \times 2 + 4000 \times 6) / (30000 + 16000 + 4000) = 206000 / 50000 = 4.12$$

4) A computer has a pipeline with 3 stages:



Non-pipelined processor:

A. How many instructions per second can this machine execute?

$$\text{number of instruction per second } f = 1/(9 \times 10^{-9}) = 111.111111 \text{ Millions}$$

B. What is the latency of an instruction?

$$\text{delay} = 2 + 2 + 5 = 9 \text{ nsec}$$

Pipelined processor:

A. How many instructions per second can this machine execute?

$$\text{number of instruction per second } f = 1/(5 \times 10^{-9}) = 200 \text{ Millions}$$

B. What is the latency of an instruction?

delay = 5 + 5 + 5 = 15 nsec

5) The state of 8088 CPU at certain time is given by the following figures. Using this figures obtain next instruction, machine code, and the value of AX, CX, and BX before and after CPU execution. Do they have same machine codes(figures 1 and 2)?

NO,

IP = 300

Fig 1

```
AX=0023  BX=0777  CX=077A  DX=0000  SP=FFEE  BP=0000  SI=0000  DI=0000
DS=11B4  ES=11B4  SS=11B4  CS=11B4  IP=0300  NU UP EI PL NZ NA PO NC
11B4:0300 31D8                XOR      AX,BX
```

```
AX=0754  BX=0777  CX=077A  DX=0000  SP=FFEE  BP=0000  SI=0000  DI=0000
DS=11B4  ES=11B4  SS=11B4  CS=11B4  IP=0302  NU UP EI PL NZ NA PO NC
11B4:0302 2020                AND      [BX+SI],AH                      DS:0777=00
```

Fig 2

```
AX=0023  BX=0777  CX=077A  DX=0000  SP=FFFE  BP=0000  SI=0000  DI=0000
DS=0DB4  ES=0DB4  SS=0DB4  CS=0DB4  IP=0300  NU UP EI NG NZ NA PO NC
0DB4:0300 31D9                XOR      CX,BX
```

```
AX=0023  BX=0777  CX=000D  DX=0000  SP=FFFE  BP=0000  SI=0000  DI=0000
DS=0DB4  ES=0DB4  SS=0DB4  CS=0DB4  IP=0302  NU UP EI PL NZ NA PO NC
0DB4:0302 C9                LEAVE
```