Question1.

What are the three basic steps in the instruction execution cycle? (3 points)

1. **fetch**
2. **decodes**
3. **executes**

Question2

What are the names of the 32-Bit General-Purpose Registers （Totally 8）(4 points)

EAX, EBX, ECX, EDX, EBP, ESP, ESI, EDI

Question3

A program contains 4 types of instructions - addition, subtraction, multiplication, and division. Addition takes 5 clock cycles, subtraction also takes 8 clock cycles, multiplication takes 10 clock cycles, and division takes 15 clock cycles. In this program, 20 % of the instructions are addition, 25% of the instructions are subtraction, 25% of the instructions are multiplication, and the rest of the instructions are division.

What is the Clocks Per Instruction (CPI)? (3 points)

The program above takes 20 seconds to run on a 2.4 GHz processor. How many instructions the program has? (4 points)

Answer :

Clocks Per instruction (CPI) = 0.2*5 + 0.25*8 + 0.25*10 + 0.30 *15= 10

Number of instructions = (2.4 * 10^9) * 20 / 10 =4.8 *10^9 instructions

Question 4 (2 points)

Name at least four CPU status flags. (0.5 points for each) any four will be ok

Bit	Name	Symbol	Use
0	Carry Flag	CF	Status
1	Reserved		1
2	Parity Flag	PF	Status
3	Reserved		0
4	Auxiliary Carry Flag	AF	Status
5	Reserved		0
6	Zero Flag	ZF	Status
7	Sign Flag	SF	Status
8	Trap Flag	TF	System
9	Interrupt Enable Flag	IF	System
10	Direction Flag	DF	Control
11	Overflow Flag	OF	Status
12	I/O Privilege Level Bit 0	IOPL	System
13	I/O Privilege Level Bit 1	IOPL	System
14	Nested Task	NT	System
15	Reserved		0
16	Resume Flag	RF	System
17	Virtual 8086 Mode	VM	System
18	Alignment Check	AC	System
19	Virtual Interrupt Flag	VIF	System
20	Virtual Interrupt Pending	VIP	System
21	ID Flag	ID	System
22 - 31	Reserved		0

- **Carry**
  - unsigned arithmetic out of range
- **Overflow**
  - signed arithmetic out of range
- **Sign**
  - result is negative
- **Zero**
  - result is zero
- **Auxiliary Carry**
  - carry from bit 3 to bit 4
- **Parity**
  - sum of 1 bits is an even number

Question 5 (4 points)

What are the values of register AL and the flags (listed below) after executing the following instructions? Please explain.

MOV AL, 7Fh

ADD AL, 9Ch

The value of register AL? (1 point) : **1B**

The Flags' values are:

Carry Flag, CF=? (1 point) **1**

Parity flag, PF=? (1 point) **1**

Auxiliary carry flag, AF=? (1 point) **1**