

2<sup>nd</sup> Year Students  
 1<sup>st</sup> Semester  
 Sheet No. 8

Academic Year 2024/2025  
 Course: **Computer Architecture**  
 Instruction Sets

## Questions:

1. Compare one-, two-, and three-address machines by writing programs to compute

$$X = (A + B \times C) / (D - E \times F)$$

For each of the three machines. The instructions available for use as follows:

1 Address	2 Address	3 Address
LOAD M	MOVE ( $X \leftarrow Y$ )	MOVE ( $X \leftarrow Y$ )
STORE M	ADD ( $X \leftarrow X + Y$ )	ADD ( $X \leftarrow Y + Z$ )
ADD M	SUB ( $X \leftarrow X - Y$ )	SUB ( $X \leftarrow Y - Z$ )
SUB M	MUL ( $X \leftarrow X \times Y$ )	MUL ( $X \leftarrow Y \times Z$ )
MUL M	DIV ( $X \leftarrow X / Y$ )	DIV ( $X \leftarrow Y / Z$ )
DIV M		

**Note:** The one-address instructions use the accumulator (AC) register implicitly.

2. Consider a register R contains 10110100, get the results of the following:

- |             |             |             |             |
|-------------|-------------|-------------|-------------|
| a. NEG R    | b. NOT R    | c. SHR R, 2 | d. SHL R, 3 |
| e. SAR R, 3 | f. SAL R, 2 | g. ROR R, 3 | h. ROL R, 2 |

3. Given the following memory values and a one-address machine with an accumulator, what values do the following instructions load into the accumulator?

- Word 20 contains 40
- Word 30 contains 50
- Word 40 contains 60
- Word 50 contains 70
- a. LOAD IMMEDIATE 20
- b. LOAD DIRECT 20
- c. LOAD INDIRECT 20
- d. LOAD IMMEDIATE 30
- e. LOAD DIRECT 30
- f. LOAD INDIRECT 30