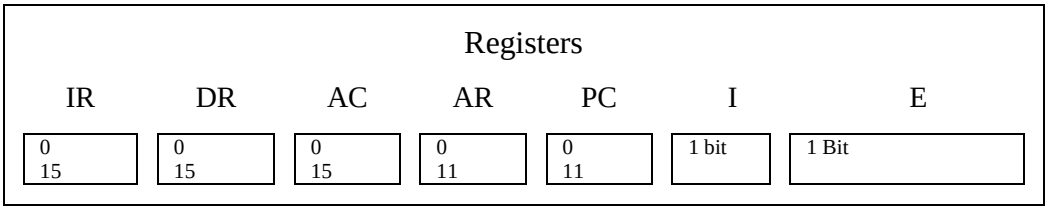
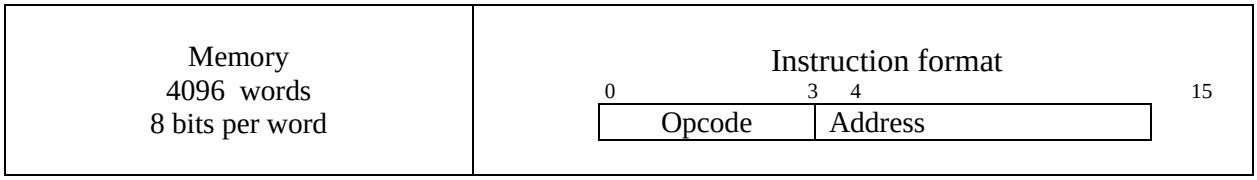
Practical List for BSc (H) Computer Science Sem I
Computer System Architecture

(Use Simulator – CPU Sim 3.6.9 or any higher version for the implementation)

1. Create a machine based on the following architecture :





Basic Computer Instructions

Memory Reference			Register Reference	
Symbol	Hex		Symbol	Hex
AND	0xxx	Direct Addressing	CLA	E800
ADD	2xxx		CLE	E400
LDA	4xxx		CMA	E200
STA	6xxx		CME	E100
BUN	8xxx		CIR	E080
			CIL	E040
ISZ	Cxxx		INC	E020
AND_I	1xxx	Indirect Addressing	SPA	E010
ADD_I	3xxx		SNA	E008
LDA_I	5xxx		SZA	E004
STA_I	7xxx		SZE	E002
BUN_I	9xxx		HLT	E001
ISZ_I	Dxxx			

Refer to Chapter-5 of Morris Mano for description of instructions.

Design the register set, memory and the instruction set. Use this machine for the assignments of this section.

2. Create a Fetch routine of the instruction cycle.
3. Write an assembly program to simulate ADD operation on two user-entered numbers.
4. Write an assembly program to simulate SUB operation on two user-entered numbers.
5. Write an assembly program to simulate AND operation on two user-entered numbers.

6. Write an assembly program to multiply two user-entered numbers.
7. Write an assembly program for simulating following memory-reference instructions.

    i. ADD
    ii. LDA
    iii. STA
    iv. BUN
    v. ISZ

8. Write an assembly language program to simulate the machine for following register reference instructions and determine the contents of AC, E, PC, AR and IR registers in decimal after the execution:

    i. CLA
    ii. CMA
    iii. CME
    iv. HLT

9. Write an assembly language program to simulate the machine for following register reference instructions and determine the contents of AC, E, PC, AR and IR registers in decimal after the execution:

    i. INC
    ii. SPA
    iii. SNA
    iv. SZE

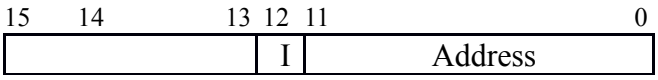
10. Write an assembly language program to simulate the machine for following register reference instructions and determine the contents of AC, E, PC, AR and IR registers in decimal after the execution:

    i. CIR
    ii. CIL

11. Write an assembly program that reads in integers and adds them together; until a negative non-zero number is read in. Then it outputs the sum (not including the last number).
12. Write an assembly program that reads in integers and adds them together; until zero is read in. Then it outputs the sum.

13. Create a machine for the following instruction format:

Instruction format



The instruction format contains a 3-bit opcode, a 1-bit addressing mode and a 12-bit address.

Write an assembly program to simulate the machine for addition of two numbers with I= 0 and address part = 082. The instruction to be stored at address 022 in RAM, initialize the memory word with any decimal value at address 082. Determine the contents of AC, DR, PC, AR and IR in decimal after the execution.

14. Referring to the instruction format in question 13, simulate the machine for the following memory-reference instructions with I= 0 and address part = 082. The instruction to be stored at address 022 in RAM. Initialize the memory word at address 082 with the operand 632 and AC with 937. Determine the contents of AC, DR, PC, AR and IR in decimal after the execution.

15. Referring to the instruction format in question 13, there are only two addressing modes, I = 0 (direct addressing) and I = 1 (indirect addressing). Write an assembly program to check the I bit to determine the addressing mode and then jump accordingly.