Jaypee University of Engineering & Technology, Guna (M.P.)
Department of Computer Science & Engineering

Course: Computer Organization & Architecture
(B. Tech. IV/VI Sem, Code: CS107/18B11CI414)

Tutorial-6
Topic: Basic Computer Organization and Design

1. A computer uses a memory unit with 256K words of 32 bits each. A binary instruction code is stored in one word of memory. The instruction has four parts: an indirect bit, an operation code, a register code part to specify one of 64 registers, and an address part.
   a. How many bits are there in the operation code, the register code part, and the address part?
   b. Draw the instruction word format and indicate the number of each bit in each part?
   c. How many bits are there in the data and address inputs of the memory?

2. The content of PC in the basic computer is 3AF (all numbers are in hexadecimal). The content of AC is 7EC3. The content of memory at address 3AF is 932E. The content of memory at address 32E is 09AC. The content of memory at address 9AC is 8B9F.
   a. What is the instruction that will be fetched and executed next?
   b. Show the binary operation that will be performed in the AC when the instruction is executed.
   c. Show the contents in hexadecimal of registers IR, PC, AR and DR of the basic computer when the instruction is fetched from the memory and executed.

3. Consider a 32-bit microprocessor having 32-bit instructions composed of two fields: the first byte contains the opcode and the remainder the immediate operand or an operand address.
   a. What is the maximum directly addressable memory capacity (in bytes)?
   b. Discuss the impact on the system speed if the microprocessor bus has:
   i. 32-bit local address bus and a 16-bit local data bus, or
   ii. 16-bit local address bus and a 16-bit local data bus.
   c. How many bits are needed for the program counter and the instruction register?

4. Consider a 16-bit computer system which executes an assembly language program stored in the memory as shown in the table. Show the contents of PC, IR, AC, DR, AR and memory in tabular form after execution of each instruction.

Memory Address in Hexadecimal	Hexadecimal Contents of memory	Instructions
500	2802	LDA
501	9801	ADD
502	3804	STA
503	7001	HLT
⋮	⋮	
801	0803	
802	E61A	
803	0BD7	
804		