Program: B.Tech

Subject Name: Computer Org. & Architecture

Subject Code: CS404

Semester: 4th

QUE 1- What is the Von Neumann Model? (Answer)
Summary - The Von Neumann Model, proposed by John von Neumann in 1945, is a theoretical framework for modern computing. It consists of a CPU, memory, input/output devices, and a control unit. Instructions and data are stored together in memory, allowing for efficient computation and sequential execution of instructions.

QUE 2- Explain the concept of addressing modes in computer systems. (Answer)
Summary - Addressing modes define how processors access data in memory. They specify various ways to calculate memory addresses for instructions or data. Common modes include direct, indirect, indexed, and relative addressing. Each mode offers flexibility and efficiency in accessing memory, contributing to the versatility of computer systems.

QUE 3- How does a microprogram sequencer work? (Answer)
Summary - A microprogram sequencer coordinates the execution of microinstructions stored in control memory. It interprets the control signals generated by the instruction decoder and fetches the appropriate microinstruction to execute. The sequencer advances through microinstructions sequentially or based on conditional branching, directing the operation of the processor's control unit efficiently.

QUE 4- What is the significance of 2's complement subtraction in computer arithmetic? (Answer)
Summary - Two's complement subtraction is crucial in computer arithmetic as it allows for efficient representation and computation of negative numbers. By using a single addition operation for both addition and subtraction, it simplifies hardware implementation. Additionally, it eliminates the need for separate subtraction circuits, reducing complexity and improving computational efficiency in digital systems.

QUE 5- Differentiate between direct and indirect addressing modes. (Answer)
Summary - Direct addressing mode accesses data directly from a memory location specified in the instruction. Indirect addressing mode retrieves data from a memory location whose address is stored in a register or another memory location. Indirect mode offers flexibility for dynamic memory access and is commonly used in pointer manipulation.

QUE 6- Describe the purpose and function of a cache in a computer system. (Answer)
Summary - A cache in a computer system serves to reduce access latency and improve performance by storing frequently accessed data closer to the processor. It

acts as a high-speed buffer between the CPU and main memory, facilitating rapid retrieval of instructions and data, thereby enhancing overall system efficiency.

QUE 7- What are the common cache mapping schemes used in computer architecture? (Answer)
Summary - Common cache mapping schemes include direct-mapped, set-associative, and fully associative. Direct-mapped caches allocate each memory block to a specific cache line. Set-associative caches group memory blocks into sets, allowing flexibility in placement. Fully associative caches allow any block to reside in any cache line, offering maximum flexibility but with higher hardware complexity.

QUE 8- Explain the differences between PCI and SCSI bus interfaces. (Answer)
Summary - PCI (Peripheral Component Interconnect) is a high-speed bus interface for connecting hardware devices to a computer motherboard. SCSI (Small Computer System Interface) is a versatile bus interface primarily used for connecting storage devices like hard drives and tape drives, offering fast data transfer rates and flexibility.

QUE 9- Define Reverse Polish notation and its application in computer systems. (Answer)
Summary - Reverse Polish notation (RPN) is a mathematical notation where operators follow their operands. It eliminates the need for parentheses in expressions, making it easier to evaluate using stacks. RPN is used in calculators and programming languages for efficient expression parsing and evaluation.

QUE 10- What is Flynn's taxonomy in the context of computer architecture? (Answer)
Summary - Flynn's taxonomy categorizes computer architectures based on instruction and data streams. It distinguishes between Single Instruction, Single Data (SISD); Single Instruction, Multiple Data (SIMD); Multiple Instruction, Single Data (MISD); and Multiple Instruction, Multiple Data (MIMD) architectures, providing insight into parallel processing capabilities.

QUE 11- How are arithmetic operations performed in a computer system? (Answer)
Summary - Arithmetic operations in a computer system are performed through binary representation of numbers. The CPU executes arithmetic instructions using logic gates to add, subtract, multiply, and divide binary digits. Arithmetic and logic unit (ALU) performs these operations by manipulating binary data according to the instructions provided by the program.

QUE 12- Discuss the concept of memory organization in computer architecture. (Answer)
Summary - Memory organization in computer architecture involves structuring memory hierarchies to optimize speed, capacity, and cost. It includes primary storage (RAM) for fast access and secondary storage (disk) for larger capacity but slower access. Cache memory serves as a bridge, storing frequently accessed data for rapid retrieval.

QUE 13- Explain the role of a control unit in a computer system. (Answer)
Summary - The control unit in a computer system manages and coordinates the execution of instructions. It interprets program instructions, directs data flow between the CPU and memory, and controls the operation of other hardware components. Essentially, it acts as the brain of the computer, orchestrating all activities to ensure proper execution of programs.

QUE 14- What is the purpose of a hardwired control unit in computer architecture? (Answer)
Summary - A hardwired control unit in computer architecture is a control mechanism built using physical circuitry. It directly implements control signals without the need for microprogramming. It offers fast operation but lacks flexibility compared to microprogrammed control units, making it suitable for simple instruction sets and specialized applications.

QUE 15- Describe the fetch and execute cycle in a computer system. (Answer)
Summary - The fetch-execute cycle is the fundamental process in a computer's operation. It involves fetching instructions from memory, decoding them to determine the operation to be performed, fetching any necessary data, executing the instruction, and storing the result. This cycle repeats continuously, driving the computer's operation.

QUE 16- How are micro instructions executed in a computer system? (Answer)
Summary - Microinstructions are elementary operations executed by a control unit in a computer processor. They control the internal operations of the processor, such as fetching data from memory, performing arithmetic operations, and managing control signals. Microinstructions are part of microprograms and are executed sequentially to execute machine instructions.

QUE 17- What is the function of a general register in a CPU? (Answer)
Summary - General registers in a CPU store operands, intermediate results, and memory addresses during program execution. They facilitate quick access to data for arithmetic, logic, and data transfer operations. General registers enhance computational

efficiency by reducing memory accesses and enabling faster data manipulation within the CPU.

QUE 18- Define the concept of instruction cycle in computer architecture. (Answer)

Summary - The instruction cycle is the basic operational process of a CPU. It consists of fetching an instruction from memory, decoding it to determine the operation to be performed, executing the instruction, and then optionally storing the result back to memory. This cycle repeats for each instruction in a program.

QUE 19- Illustrate the different phases of an instruction cycle. (Answer)

Summary - The instruction cycle consists of fetch, decode, execute, and store phases. In fetch, the CPU retrieves an instruction from memory. In decode, it interprets the instruction's opcode and operands. In execute, it performs the instruction's operation. In store, it may save results back to memory.

QUE 20- Explain the implementation of a 1-bit register in computer systems. (Answer)

Summary - A 1-bit register in computer systems is typically implemented using a flip-flop circuit, storing a single binary digit (0 or 1). It maintains its state until updated. Flip-flop's output connects to its input, creating a feedback loop. It serves as the basic building block for larger registers and memory units.

QUE 21- What is the functional block diagram of a microprocessor 8085? (Answer)

Summary - The functional block diagram of a microprocessor 8085 includes the following blocks: Arithmetic and Logic Unit (ALU), Control Unit (CU), Instruction Register (IR), Program Counter (PC), Registers, Timing and Control Unit (TCU), and Address/Data Bus Interface. These components work together to execute instructions and manage data flow within the processor.

QUE 22- Discuss the purpose of the General register, Memory register, and instruction register in a computer system. (Answer)

Summary - General registers store data temporarily for processing within the CPU. Memory registers hold data temporarily during memory operations, facilitating data transfer between CPU and memory. Instruction registers temporarily hold the current instruction being executed, providing operands and operation codes for CPU execution in computer systems.

QUE 23- How is sequencing and execution of micro instructions carried out? (Answer)

Summary - Micro instructions are elementary operations executed by a CPU's control unit. They include actions like fetching data from memory, performing arithmetic/logic operations, managing control signals, and storing results. Micro instructions are executed sequentially as part of a microprogram to implement machine-level instructions efficiently within the CPU.

QUE 24- Describe the concepts of instruction and the instruction cycle with a neat diagram. (Answer)

Summary - The instruction cycle is the fundamental process by which a computer executes instructions. It consists of fetching instructions from memory, decoding them, executing the operation, and storing the results. This cycle repeats continuously. The instruction cycle diagram typically illustrates these steps sequentially, forming a loop representing the repetitive nature of instruction execution.

QUE 25- Define the different addressing modes and provide examples. (Answer)

Summary - Addressing modes in computer architecture dictate how CPU instructions refer to operands. Modes include Direct (address of operand), Indirect (address in a memory location), Immediate (operand value itself), Register (operand stored in register), and Indexed (address calculated using base address and offset). Example: Direct: MOV A, [1234].

QUE 26- Explain the categories of addressing modes with examples. (Answer)

Summary - Addressing modes in computer architecture refer to techniques for specifying operands in machine instructions. Categories include:

1. Register: Operand is directly specified in a register. Example: MOV AX, BX.
2. Immediate: Operand value is directly specified within the instruction. Example: ADD AX, 5.
3. Direct: Operand's memory address is specified directly. Example: MOV AX, [1234].
4. Indirect: Operand's memory address is specified indirectly via a register. Example: MOV AX, [BX].

QUE 27- What is a control word and how is it represented in a computer system? (Answer)

Summary - A control word is a binary sequence used to command operations in a computer system, such as initiating memory transfers or directing arithmetic operations. It's typically represented as a fixed-length binary string stored in memory or passed between components, encoding specific instructions for system functions.

QUE 28- Discuss the steps involved in the execution of micro instructions. (Answer)

Summary - Microinstructions are basic operations executed by a CPU's control unit. They control internal processes like fetching data, performing arithmetic/logic operations, managing control signals, and storing results. Microinstructions are part of microprograms, guiding the execution of machine-level instructions within the CPU efficiently and sequentially.

QUE 29- Perform computations using 8-bit two's complement integers. (Answer)

Summary - Using 8-bit two's complement integers, computations involve binary arithmetic with a range from -128 to 127. Arithmetic operations include addition, subtraction, multiplication, and division. Overflow can occur when results exceed the representable range. These computations are foundational in digital systems, cryptography, and embedded systems.

QUE 30- Explain the concept of programmed I/O in computer systems. (Answer)

Summary - Programmed I/O is a data transfer method in computer systems where the CPU directly controls data transfer between peripheral devices and memory. It involves CPU-managed polling or busy waiting, making the CPU continuously check the status of devices until data transfer is complete, which can be inefficient for large data transfers.

QUE 31- What are the functional and structural views of a computer system? (Answer)

Summary - The functional view of a computer system focuses on what tasks the system can perform and how it interacts with users and software. The structural view examines the physical components and architecture of the system, including hardware, connections, and data pathways, to understand how it operates.

QUE 32- Draw and explain the typical hardwired control unit. (Answer)

Summary - A hardwired control unit in computer architecture is a control mechanism built with physical circuits. It directly generates control signals without microprogramming, making it faster but less flexible than microprogrammed control units. Hardwired control units are suitable for simple instruction sets and specialized applications where speed is paramount.

QUE 33- Differentiate between infix and postfix notation with an example. (Answer)

Summary - In infix notation, operators are placed between operands (e.g., 2 + 3 * 4). In postfix notation, operators follow operands (e.g., 2 3 4 * +). Postfix eliminates the need for parentheses and follows a fixed order of evaluation, making it easier for computers to process.

QUE 34- Calculate cache access time given main memory access time and hit ratio. (Answer)
Summary - Cache access time = Main memory access time × (1 - Hit ratio).

QUE 35- Illustrate the multiplication of two numbers using Booth's algorithm. (Answer)
Summary - Booth's algorithm is a technique for multiplying signed binary numbers efficiently. It reduces the number of partial products generated by identifying sequences of consecutive bits in the multiplier. These sequences determine whether to add, subtract, or shift partial products, simplifying the multiplication process and saving computational steps.

QUE 36- How does data transfer occur between registers and memory? (Answer)
Summary - Data transfer between registers and memory occurs through bus lines controlled by the CPU. During a read operation, the CPU sends the memory address to the memory controller, which retrieves the data and sends it back through the bus to the CPU's registers. During a write operation, the CPU sends the data along with the memory address to the memory controller for storage.

QUE 37- Explain the purpose of a 1-bit register in computer architecture. (Answer)
Summary - A 1-bit register in computer architecture serves as the smallest unit of storage, capable of storing a single binary digit (0 or 1). It is used for temporary data storage, Boolean logic operations, and as a building block for larger registers and data pathways within the processor.

QUE 38- Describe the functional block diagram of a microprocessor 8085. (Answer)
Summary - The 8085 microprocessor is an 8-bit microprocessor introduced by Intel in 1976. It features a simple instruction set, five 8-bit registers, and various addressing modes. The 8085 is widely used in embedded systems and educational environments due to its ease of use and widespread availability.

QUE 39- Compare and contrast direct and indirect addressing modes. (Answer)
Summary - Direct addressing mode directly specifies the memory address of the operand. Indirect addressing mode uses a memory address that points to the location of

the operand. Direct addressing is simpler but limited in flexibility, while indirect addressing allows for more dynamic memory access but is slightly more complex.

QUE 40- Define instruction code and its components. (Answer)
Summary - An instruction code is a binary representation of a machine instruction in computer programming. Its components include an operation code (opcode) specifying the operation to perform, operand specifier indicating data location, and operand address providing the memory location of the operand.

QUE 41- Determine the number of operations a specific instruction code can perform. (Answer)
Summary - Determining the number of operations a specific instruction code can perform depends on the architecture and design of the processor. It typically involves examining the opcode field of the instruction set architecture to identify the range of operations supported, such as arithmetic, logical, control transfer, and data movement operations.

QUE 42- Explain the concept of a program counter in computer systems. (Answer)
Summary - A program counter in computer systems is a register that stores the memory address of the next instruction to be fetched and executed. It ensures the sequential execution of instructions by incrementing after each instruction fetch, facilitating the orderly progression of program execution.

QUE 43- Discuss the role of a microprogram sequencer in executing instructions. (Answer)
Summary - A microprogram sequencer coordinates the execution of microinstructions stored in control memory. It interprets control signals from the instruction decoder and fetches the appropriate microinstruction for execution. The sequencer advances through microinstructions sequentially or based on conditional branching, directing the operation of the processor's control unit efficiently.

QUE 44- What is the difference between a direct and an indirect addressing mode? (Answer)
Summary - Direct addressing mode accesses memory directly using a specific memory address provided in the instruction. Indirect addressing mode accesses memory indirectly by using the content of a register or memory location as the address. Direct mode specifies the exact location, while indirect mode uses a pointer to access data.

QUE 45- Define the concept of a memory address register in a computer system. (Answer)
Summary - The Memory Address Register (MAR) in a computer system temporarily holds the address of the memory location being accessed for read or write operations. It communicates with the memory unit to specify the location where data is to be fetched from or stored to during program execution.

QUE 46- Explain the significance of a memory data register in computer architecture. (Answer)
Summary - The memory data register (MDR) in computer architecture serves as a temporary storage unit between the CPU and memory. It holds data retrieved from or to be written to memory, facilitating efficient data transfer. The MDR plays a pivotal role in ensuring smooth communication between the CPU and memory subsystems.

QUE 47- Describe the purpose of an instruction register in a CPU. (Answer)
Summary - The instruction register in a CPU stores the current instruction being executed. It holds the opcode, specifying the operation to be performed, and operands. The CPU fetches instructions from memory, loads them into the instruction register, and executes them sequentially, controlling the flow of operations within the processor.

QUE 48- How are memory locations accessed in a computer system? (Answer)
Summary - Memory locations in a computer system are accessed through addressing mechanisms. The CPU generates memory addresses that correspond to specific locations in RAM. These addresses are sent to the memory controller, which retrieves data from or stores data into the corresponding memory location. Access speed depends on memory hierarchy and technology.

QUE 49- Discuss the importance of a program counter in instruction execution. (Answer)
Summary - The program counter (PC) is crucial in instruction execution as it tracks the memory address of the next instruction to be fetched and executed. It ensures sequential execution, facilitates branching and looping, and maintains program flow integrity, essential for the correct operation of computer programs.

QUE 50- Explain the concept of a microprogram sequencer and its function in a CPU. (Answer)
Summary - 'A microprogram sequencer in a CPU controls the execution of microinstructions stored in control memory. It interprets the current microinstruction and determines the next one to execute based on the CPU's state. This enables the CPU to

efficiently execute complex instructions by breaking them down into simpler microoperations.