Digital Electronics and Computer Organization (UCS1001)
Odd Semester 2024-25

Question Bank

Unit-1:

1. Explain all the logic gates with their symbols, expressions, and truth tables.
2. Discuss the De-Morgan's Law including their logical diagrams and truth tables.
3. Write the truth table of the following Boolean Expressions and draw the logical diagram of given expressions:
   a. Y = AB' + A'B
   b. Y = AB'C + A'B
4. Simplify the following expressions using K-map:
   a. Z(A,B,C,D) = Σm(1,2,3,5,7,11,13)
   b. Z(A,B,C,D) = Σm(0,1,3,6,8,10,11,12,15)
5. Simplify the following expressions using K-map:
   a. Z(A,B,C,D) = Σm(1,2,4,5,8,9,10,13) + d(6,11,13,14)
   b. Z(A,B,C,D) = Σm(0,1,3,6,7,10,11,12) + d(2,8,13,14)
6. Simplify the following expressions using K-map:
   a. Z(A,B,C,D) = ∏M(1,3,4,6,7,9,11,13,15)
   b. Z(A,B,C,D) = ∏M(1,2,4,5,8,11,13,14)
7. Simplify the following expressions using K-map:
   a. Z(A,B,C,D) = ∏M(0,1,3,5,8,10,12,14).d(4,7,13)
   b. Z(A,B,C,D) = ∏M(2,3,5,6,10,12).d(7,11,15)
8. Implement the following Boolean Expressions using NAND gate only:
   a. Y = A + BC'
   b. Y = AB' + C'
9. Implement the following Boolean Expressions using NOR gate only:
   a. Y = A + BC'
   b. Y = AB' + C'
10. Explain Half Subtractor including truth table, expression, and logic circuit.
11. Explain and verify the De-Morgan's Law of 3 Variables.
12. Write the Truth Table of 3 input NAND, NOR and XOR gates.
13. Write the truth table of the following Boolean Expressions and draw the logical diagram of given expressions:
   a. Y = AB + B'C
   b. Y = A' + BC
   c. Y = AC' + B'D
   d. Y = B + A'C
14. Write all the Minterms and Maxterms of 4 variables in Tabular form.
15. Simplify the following expressions using K-map:
   a. Z(A,B,C) = Σm(0,1,3,7)
   b. Z(A,B,C,D) = Σm(0,2,3,5,7,9,11,13,15)
   c. Z(A,B,C,D) = Σm(0,1,4,6,9,10,12)
16. Simplify the following expressions using K-map:
   a. Z(A,B,C) = Σm(0,1,3,7) + d(2,4)
   b. Z(A,B,C,D) = Σm(0,2,3,5,7,9,11,13,15) + d(1,6,8,14)
   c. Z(A,B,C,D) = Σm(0,1,4,6,9,10,12) + d(2,3,13,14,15)
17. Simplify the following expressions using K-map:

a. Z(A,B,C) = ∏M(0,1,2,6)
b. Z(A,B,C,D) = ∏M(0,1,3,6,7,9,10,13,14)
c. Z(A,B,C,D) = ∏M(1,3,5,9,11,12,13)

18. Simplify the following expressions using K-map:
a. Z(A,B,C) = ∏M(1,6,7).d(2,3)
b. Z(A,B,C,D) = ∏M(0,3,5,9,11,12,15).d(1,4,7,13)
c. Z(A,B,C,D) = ∏M(0,1,5,6,12).d(2,3,11,15)

19. Implement the following Boolean Expressions using NAND gate only:
a. Y = A + BC'
b. Y = A' + B'C

Unit-2:

1. Explain Half Subtractor including truth table, expression, and logic circuit.
2. Explain Full Adder with the help of truth table, expression, and logic circuit.
3. Discuss the 2:4 Decoder with logic gates.
4. Implement 4:1 Multiplexer with the help of logic gates.
5. Design 4:2 encoder.
6. Explain the design procedure of combinational circuits.
7. Differentiate combinational and sequential circuits.
8. Explain 1:2 decoder.
9. Write the truth table of full subtractor.
10. Explain 2:1 MUX.

Unit-3:

1. Define the role of the Control Unit (CU) in a computer system.
2. What is the difference between the Arithmetic Logic Unit (ALU) and the Memory Unit?
3. List the five major functional units of a computer system and briefly describe their functions.
4. What are the primary steps in an Instruction Cycle?
5. Explain how a computer processes data stored in memory using the fetch-decode-execute cycle.
6. Why is the Program Counter (PC) important in instruction execution?
7. What are the main types of buses in a computer system, and what does each do?
8. Explain the concept of bus arbitration and why it is needed.
9. Define the following terms:
   - Processor Clock
   - Clock Rate
   - Clock Cycle Time
10. Write down Basic Performance Equation and elaborate.
11. How does a write operation differ from a read operation?
12. Why is it important to maintain proper instruction sequencing in a computer program?
13. Write a short program in assembly language using immediate addressing mode and explain how it works.
14. Discuss the different functional units of a basic computer and explain how these units interact with each other through the bus structure.
15. Explain the basic operational concepts of a computer system, illustrating the steps involved in instruction execution with a clear and labelled diagram.
16. Describe the basic types of machine instructions in computer systems based on address formats. Provide examples for each type, including zero-address, one-address, two-address, and three-address instructions.

17. Describe the process of instruction execution and straight-line sequencing. How the concepts of branching impact the program flow?
18. Explain the different types of addressing modes used in computer systems. Describe each mode in detail with examples.
19. Explain the concept of bus structure in a computer system. Why is it essential for connecting different functional units?
20. What are memory locations and addresses in computer systems? Describe how they are used in memory operations.
21. What is the role of the Arithmetic and Logic Unit (ALU) in a computer system?
22. Define the term 'clock rate' in computer system and its significance in determining processor speed.
23. What is an instruction in a computer system, and how is it executed?
24. What are addressing modes in computing? Provide two examples.

Unit-4:

1. Explain about I/O interface devices in brief. Also, discuss different I/O interface techniques.
2. Explain the term peripheral devices. Discuss various peripheral devices in brief.
3. Describe the I/O interface. Explain the need for an I/O interface.
4. Write a short note on interrupts.
5. Explain the operation of the cache.
6. Explain the hardware interrupt in brief.
7. In cycle-stealing data transfer mode (DMA), the device can make one or two transfers; and comment on them with proper justification.
8. Explain about I/O interface devices in brief. Also, discuss different I/O interface techniques.
9. Discuss the interrupt in the processor's context and explain its classifications.
10. Explain the uses of interrupt in context to the processor Also, discuss the process of execution of an interrupt.
11. What do you mean by I/O organization?
12. Explain term Bus Request.
13. Explain how I/O devices can be accessed. Also, discuss different I/O techniques.
14. Draw and explain the block diagram of the DMA Controller.
15. What is interrupt? Explain its types in detail. Also, discuss the process of execution of an interrupt.
16. What is an interrupt?
17. Explain term cycle stealing.
18. What do you understand by terms I/O interface? Discuss it with the diagram.
19. Discuss the interrupt in the processor's context and explain its classifications. Also discuss, how interrupts can be enabled or disabled?
20. What are peripheral devices? Explain it in detail. Also, discuss I/O address lines.
21. Discuss direct memory access suitable block diagram explaining its operation in detail.
22. Explain the term DMA burst and cycle stealing.
23. Explain the various registers in the DMA controller in detail.

Unit-5

1. What is a pipeline hazard?
2. Describe different operations of ALU.
3. Explain the Design of ALU in detail.

4. Describe pipeline process in a computer architecture. Define throughput and speedup performance factors.
5. What is the need of Cache memory? Explain various mapping techniques associated with Cache memory.
6. What is cache memory?
7. Explain process of pipelining.
8. Describe pipeline technique and pipeline performance in detail.
9. Discuss the different mapping techniques used in Cache memory with their merits and demerits.
10. Describe different operations of ALU in detail.

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