1. What is computer Organization?
    Computer Organization is concerned with the way the hardware components operate and the way they are connected together to form the computer system.
2. What is computer Architecture?
    The computer architecture is concerned with the structure and behavior of the computer which is seen by the user. It includes the information formats, instruction set and techniques for addressing memory.

3. What is a gate?
    The manipulation of binary information is done by logic gates. The gates are blocks of hardware that produce signals of binary 1 and 0 when input logic requirements are satisfied.

4. What is a signal?
    The binary information is represented in digital system computers by means of physical quantities called as signals.
    Electrical signals such as voltages exist throughout the computer in one of two recognized states. The two states represent binary variable that can be 0 and 1.
5. What is a Boolean function?
    Boolean algebra is an algebra that deals with binary variables and logic operations. The variables are designated by letters like A, B ,x and y. A Boolean function can be expressed algebraically with binary variables, logic operation symbols , parentheses and equal sign.

6. Expand the terms : SSI,MSI,LSI,VLSI,ULSI

    (i)   SSI   - Small scale integration
    (ii)   MSI   - Medium scale integration
    (iii)   LSI   - Large scale integration
    (iv)   VLSI   - Very large scale integration
    (v)   ULSI   - Ultra large scale integration
7. What is self-complementing code?
    The self complementing property is that the 9's complement of a decimal number when represented in 2421 and Excess-3 codes, is easily obtained by changing 1's to 0's and 0's to 1's. This property is useful when arithmetic operations are done in signed complement representation.
8. List out the example of self-complementing code.
            (i)   2421
            (ii)   Excess-3
9. What is weighted code? Give an example.

The meaning of weighted code is that the bits are multiplied by the weights indicated and the sum of the weighted bits gives the decimal digit. For example the bit 1101, when weighted by the respective digits of 2421, gives the decimal equivalent of $2 \times 1 + 4 \times 1 + 2 \times 0 + 1 \times 1 = 7$. Also BCD codes can be assigned with the weights 8421 and called as 8421 BCD.
Example code is 2421 and 8421.

10. List out the unweighted code.

Excess 3 is the unweighted code, Gray code.

11. What is the Excess-3 Code?
The excess-3 code is the decimal code that is used in olden computers. Its binary assignment is obtained from the corresponding BCD equivalent of the number after the addition of binary 3 (0011).

12. List out the alphanumeric codes.
   (i)   ASCII   -   American Standard Code for Information Interchange
   (ii) EBCDIC -   Extended BCD Interchange code

13. What is an error detection code?
An error detection code is a binary code that detects the digital errors during transmission. The detected errors cannot be corrected but their presence is indicated. If errors occur infrequently at random, the particular erroneous information is transmitted again. If the errors occurs too often, the system is checked for malfunction.

14. What is a parity bit?
Parity bit is used for error detection. It is an extra bit included with the binary message to make the total number of 1's either odd or even.

15. Why NAND and NOR gates are called as universal gate?
NAND and NOR gates are used for constructing other gates. That is NAND and NOR gates are design to function as OR,AND,NOT and EX-OR gates. This property is not available in other gates.

16. What is a multiplexer?
Multiplexer is a combinational circuit, which has many inputs and only one output. That is multiplexer receives many inputs and only one input is transferred to output by using the control signals. In general multiplexer means many to one. The short form of Multiplexer is MUX.

17. What is a De-multiplexer?
The De-multiplexer performs a function opposite of multiplexer. That is it has one input and many outputs. Based on the control input one of the output lines will become active and will output the data. In general De-multiplexer means one to many.

18. What is half-adder?
Half adder is a combinational circuit which is used to add two bits . It has two inputs and two outputs. The outputs are called as SUM and CARRY.

19.   What is half-subtractor?

Half subtractor is a combinational circuit which is used to subtract two bits. It has two inputs and two outputs. The outputs are called as Difference and Borrow.

20.   What is a full adder?
The full adder adds more than two bits. That is it has two inputs and two outputs. The outputs are called as SUM and CARRY.   The formula for sum is $A \oplus B \oplus C$ and carry is $AB + BC + AC$.

21. What is full-subtractor?
    The full subtractor is a combinational circuit which is used to subtracts more than two bits. It has three bits as inputs and two outputs. The outputs are called as difference and borrow. The

    formula for difference is $A \oplus B \oplus C$ and borrow is $\overline{A}B + BC + A\overline{C}$.

22. **What is an encoder?**
    The encoder is the circuit which converts an active input signal into a coded output signal. In general the encoder accepts 2^n inputs and n outputs. For example it has 8 inputs and 3 outputs. **That is $8 = 2^3$ inputs and 3 outputs.**   Also in general the encoder accepts any code form and its output is always binary.
    Examples of encoders are octal to binary encoder , decimal to BCD encoder.

23. What is a decoder?
    The decoder works opposite to encoder. It has n inputs and 2^n outputs. For example if it has 3 inputs and its output is 8.   In general the decoder input is binary and output is any form. Examples of decoder is BCD to decimal decoder.

24. Define Karnaugh Map?
    The Boolean function is implemented on a logic circuit, the simplicity of the circuit depends on the simplicity of the Boolean function. The truth table representation of a Boolean function is unique, but the function can appear in many different forms when expressed algebraically.

    The karnaugh map simply called as K-map which is a representation of a Boolean function provides a simple , straight forward procedure for simplifying Boolean expression in minimal form. The K-map is a visual display of a fundamental products (minterms) needed for the sum of products solution. It gives the simplest expression with minimum number of literals.   It is a diagram made of several squares , each square representing   one minterm in a systematic manner. The squares corresponding to minterms that produce a "1" for the function are marked by 1 and others are marked by a 0 or left empty. By recognizing various patterns and combining squares marked by "1" 's in the map it is possible to derive alternative expressions for the function from which the most convenient .

25. What is a pair?
    Pair is a two 1's which are adjacent. Pair eliminates one variable and its complement from the map.

26. What is a Quad?
    Quad is group of four 1's that are end to end.   Quad eliminates two variables and its complements from the map.

27. What is an Octet?

Octet is a group of eight adjacent 1's. An octet eliminates three variables and its complements from the map. Also Octet is a visualize as two quads.

28. What is overlapping?

When you encircle the group, you are allowed to use the same 1 more than once.

29. What is rolling?

When you encircle the pair, the left side touches the right side. It is called rolling. If we visualizing the rolling correctly, two pairs actually forms a quad.

30. Define redundant Group?

After we encircle the groups, there is one more thing to do before writing the simplified Boolean equation. Eliminate any group whose 1's is completely overlapped by other groups. A group whose 1's are all overlapped by other groups is called the redundant group.

31. Define don't care condition?

Sometimes it doesn't matter what the output is for a given input word. To indicate this we use a X in truth table instead of 0 or 1. The X's are called as don't care conditions.

32. What is a Gray code?

Gray code is an unweighted code in which successive numbers differ in only one bit position. Such codes are used in analog to digital conversion. Gray code is not convenient for arithmetic operation. Such a code in which not more than one bit differs from its neighbours is called the Gray code or reflected code. This concept is formalized by the what is known as Hamming distance.

33. Expand the terms SOP ,POS,CMOS

SOP   -   Sum of Product
POS   -   Product of SUM
CMOS   -   Complementary metal oxide semiconductor

34. Define Sum-of-products(SOP):

A sum of products expression is a product term called minterm or several product terms (minterms) logically ORed together.

        Example AB + AC

The following steps are followed to express a Boolean function in its sum-of-products form.

        (i)   Construct a truth table for the given Boolean function.
        (ii)   Form a minterm for each combination of the variables which produces a 1 in the function.
        (iii)   The desired expression is the sum(OR) of all the minterm obtained in step 2.

35. Define Product-of-Sum(POS).

A product of sum expression is a sum term called maxterm or several sum terms (maxterms) logically multiplied (AND-ed) together. The following steps are the steps followed to express a Boolean function in its product-of-sums forms :

(i)   Construct a truth table for the given Boolean function.
(ii)   Form a maxterm for each combination of the variables which produces a 0 in the function.
(iii)   The desired expression is the product(AND) of all the maxterms obtained in step 2.

36. What is a combinational circuit?

Combinational circuits are interconnected circuits of gates according to certain rule to produce an output depending on its input value. The combinational circuits should not have feedback values. A combinational circuit can be represented as a network of gates

37. What is an sequential circuit?

Sequential circuits unlike combinational circuits are time dependent. Normally the current output of a sequential circuits depends on the state of the circuit and on the current input to the circuit. It is a connection of flip-flops and gates. There are two types of sequential circuits. They are (i) synchronous ,(ii) Asynchronous.

Synchronous circuits use flip-flops and their status can change only at discrete event.

Asynchronous sequential circuits may be regarded as a combinational circuits with feedback path.

38. What is a flip-flop?

Flip-flop is a binary cell which can store a bit of information. It is a simplest form of sequential circuit. The simplest form of sequential circuit is flip-flop. A flip-flop is a bistable device, that is , it can remain in one of the two stable states which are designated as "0" and "1" states. It is the fundamental logic circuit used for storing information in digital systems. The flip-flop has two outputs. One is the normal(Q) output, and other is complmentary(Q') output.

39. What is a register?

A register is a binary function that hold the binary information in digital form. A register consist of a group of binary storage cells. A register consist of one or more flip-flops depending on the number of bits to be stored. A single flip-flop is used for storing a bit of a word.

40. What is a shift register?

A register which is used for shifting the data to the left or right is called as shift register. (or) A shift register moves the stored bit to left or right. The shifting is essential for certain arithmetic and logic operations used in microcomputers. There are two types of shift register, they are shift left register and shift right register.

41. What is a counter?

A counter is a register capable of counting the number of clock pulses that have arrived at its clock input. In its simplest form it is the electronic equivalent of a binary odometer. It is a sequential circuit. A counter is a register whose value is incremented by 1 on the occurrence of some event. When the value stored in counter reaches the maximum value it can store, the next incremented value becomes zero. There are two types of counters, (i) Asynchronous counter, (ii) Synchronous counter. The difference between synchronous and asynchronous counters is , in asynchronous counter the state of one flip-flop changes at a time, while in synchronous counter the state of all the flip-flops can be changed at same time.

In asynchronous counter the first flip flop receives the clock input directly. The second flip-flop receives the clock input from the output of first flip-flop and so on. So the clock strikes the first flip-flop only, its output is connected to the clock input of second flip-flop.

In synchronous counter all flip-flops receives the clock input simultaneously.

42. Expand the terms TTL,ECL .

TTL - Transistor-Transistor Logic

EC L – Emitter Collector Logic

43. Expand the terms LSB and MSB.

LSB – Least Significant bit

MSB – Most significant bit.

44. Define one's complement.
One's complement is nothing but changing 1 to 0 and 0 to 1 of a binary number.
45. Define two's complement.
Two's complement is done by adding 1 to the LSB of 1's complement.
46. What is 9's complement.
9's complement of a number is achieved by subtracting every digit from 9.
47. What is 10's complement.
10's complement of a number is achieved by adding 1 to the LSB of 9's complment.
48. Define radix.
Radix is nothing but the base of the number system. For example , the binary number system has a base of 2, octal number system has base of 8, decimal number system has a base of 8 and hexa-decimal number system has a base of 16.
49. List out the various flip-flops
(i)   RS flip-flop
(ii)   Clocked RS-flip flop
(iii)   JK flip-flop
(iv)   Master-Slave Flip Flop
(v)   D flip-flop
(vi)   T flip-flop
50. Expand the T and D flip-flop
D – Delay flip-flop
T – Toggle flip flop.
51. What do you mean by toggle?
Toggle is defined as the complement of the output of the previous state.
52. Expand the terms MAR and MDR :
MAR – Memory address register
MDR – Memory data register.
53. What is a microoperation?
The operation performed on data stored in registers is called microoperation. There are four types of microoperations, they are (i) register transfer microoperation, (ii) arithmetic microoperation, (iii) Logical microoperation , (iv) shift mcirooperations.
54. What is a three state gate?
A three-state gate is a digital circuit that exhibits three states,. Two of the states are equivalent to 0 and 1. The third state is a high impedance state. The high impedance state behaves like open circuit , which means that the output is disconnected and does not have a logical significance.
55. Expand the terms shl,shr,cil,cir
Shl – logical shift left
Shr – logical shift right
Cil- circular shift left
Cir – circular shift right
56. Expand RPN
RPN – Reverse Polish Notation
57. Expand CISC and RISC.
CISC – Complex Instruction Set Computer
RISC – Reduced instruction set computer

58. What is PC(Program Counter)?

The program counter is a register that keep track of the instructions in the program stored in memory. PC holds the address of the instruction to be executed next and is incremented each time an instruction is fetched from memory.

59. What is addressing mode?

It is defined as the way the operands are chosen during program execution is dependent on the addressing mode of the instruction. The addressing mode specifies a rule for interpreting or modifying the address field of instruction before the operand is actually referenced.

60. What is a common bus?

The efficient scheme for transferring information between registers in a multiple register configuration is a common bus system. The bus structure consists of a set of common lines , one for each bit of a register, through which binary information is transferred one at a time. Control signals determine which register is selected by the bus during each particular register transfer.

61. What is a control function?

A control function is a Boolean variable which equal to 1 or 0. It is used to separate the control variables from the register transfer operation.

62. What is a register transfer language?

The symbolic notation used to describe the microoperation transfers among registers is called register transfer language. The word transfer is used in microoperation and the term language is borrowed from the programmers.

63. Give an example of reflected code.

Gray code.

64. What is demorgan's first theorem?

Complement of sum is equal to the product of the complements

$$\overline{A+B} = \overline{A}.\overline{B}$$

65. What is demorgan's second theorem?

Complement of the product is equal to the sum of the complments

$$\overline{A.B} = \overline{A} + \overline{B}$$

66. List out various Boolean laws

(i) Commutative Law : $A + B = B + A$

$AB = BA$

(ii)Associative Law   : $A + (B+C) = (A + B) + C$

$A(BC) = (AB)C$

(iii)Distributive Law : $A(B+C) = AB + AC$

(iv)OR Law : (a) $A + 0 = A$

(b) $A + A = A$

(c) $A + 1 = 1$

(d) $A + \overline{A} = 1$

(v) AND Law :   A . 1 = A

                                  A . A = A

                                  A . 0 = 0

                                  $\overline{A} $
                                  A . $\overline{A}$ = 0

(vi) Double Inversion Law

                                  $\overline{\overline{A}}$ = A

66. Define Duality Theorem.

The duality theorem is one of the elegant theorems in advanced mathematics. It is starting with a Boolean relation, we can derive another Boolean relation by

(i)   Changing each OR sing to an AND sing

(ii)   Changing each AND sing to an OR sing

(iii)   Complementing any 0 or 1 appearing in the expression.

For example , we have   A + 0 = A

The dual relation for the above is   A . 1 = A

Also the another example is change the following expression to duality relation as

$$A(B + C) = AB + AC$$

The duality for the above is,

$$A + BC = (A + B) . (A + C)$$

67. Write short note on Hexadecimal number.

Hexadecimal numbers are used extensively in microprocessors and assembly language. They are much shorter than binary numbers. It is easier to convert them directly into binary form. In most computers, the memory is organized into sets of "bytes", consisting of eight binary digits or bits. Each byte is used as a single entity to represent a single alphanumeric character or it is broken into two four bit pieces. Each 4-bit group is called as a "nibble". When the computer handles the binary numbers in nibbles, it is convenient to have a code for representing each of these group of 4-bits. Since with 4-bits, sixteen possible different numbers can be represented, so we need base-16 or hexadecimal number system. Moreover, while specifying the contents of a register of a digital computer, it is always convenient to use octal or hexadecimal codes, instead of using a long string of binary digits.

For example, a binary number 1011 1111 1111(12 digits) can be expressed BFF(three digits) in hexadecimal system or as 5777(four digits) in octal system

Hexadecimal number system has a base of 16 and it uses sixteen different symbols. They are the digits 0 through 9 and the alphabets A,B,C,D,E and F. While counting in hexadecimal system,

after reaching 9, one has to continue counting with A,B,C,D,E and F. After F, a carry is sent to the next MSD and the counting again continued from 0.

Thus the hexadecimal numbers are
0,1,2,3…….9,A,B….F,10,11……19,1A,1B……1F,20,21,…..29,2A,2B….2F,30,31…..3F ………….. and so on.

68. What is a nibble?
The nibble consists of 4-bits.

69. What is the method to convert binary to decimal number?
To convert binary to decimal number we use positional notation and weights.

70. What are the basic logic gates?
The basic logic gates are AND,OR and NOT.

71. What is a race condition in RS flip flop?
Race condition occurs in RS flip flop when both inputs R and S equal to 1. When both inputs are 1, the outputs Q and Q' are try to occupy the 1 state. This is against the principle of the operation of the flip flop. Moreover, if the inputs are now changed , the next state of the flip-flop is unpredictable. The next state actually depends on which gate is faster to change its present state. This prohibited state is called as RACE condition.

72. Expand the term BCD and NBCD
BCD – Binary Coded Decimal
NBCD-Nibble Binary Coded Decimal

73. What is a ripple counter?
The counter is called as ripple counter because the carry moves through the flip-flops like the ripple on water.

74. What is modulus of the counter?
The modulus of the counter is the number of output states it has. For example a 4-bit ripple counter has a modulus of 16 because it has 16 distinct states numbered from 0000 to 1111.

75. What is MOD-10 counter?
The MOD-10 counter counts ten values from 0000 to 1111. It is also called as decade counter.

76. Draw the table consist of Hexadecimal, binary and decimal numbers

DECIMAL NUMBER	BINARY NUMBER	HEXADECIMAL NUMBER
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8

9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

77. What are the unused bits in BCD?
The unused bits are 1010,1011,1100,1101,1110 and 1111. These bits are redundant bits.

78.