PAPER I
Gr A: Computer Fundamentals

1. Distinguish in between *data* and *information.*
2. Draw the block diagram of a computer and explain the functionality of each unit.
3. What do you mean by software, hardware and firmware?
4. What do you mean by systems software? Give two examples each of systems software and application software.
5. Describe briefly about the generation of the computers.
6. What is the difference between a mainframe and a PC?
7. Draw a flowchart to compute the greatest common divisor of two integers. How comments can be expressed in a flowchart?
8. Write an algorithm to solve the above problem using recursion.
9. 'All floating-point numbers, even within the maximum and minimum range permissible cannot be represented within a computer'- justify.
10. How signed integers are represented in a computer?
11. What do you mean by fixed-point representation and floating-point representation?
12. Convert each of the following eight bit numbers in one's complement, two's complement, signed magnitude and excess $128(2^{n-1})$ notation:

    123, -13, 419, 0
13. Perform the following BCD (3 digit) arithmetic:

    73-34, 121+413
14. Find the value of 1011.11-101.01 using 2's complement notation.
15. Show that the 1's complement of the excess 3 representation of a BCD number is equal to the excess 3 representation of the 9's complement of the same number.
16. Write an algorithm to convert a number represented in radix r_1 to radix r_2.
17. Design an algorithm to multiply two fixed-point signed integers.
18. Design an algorithm to divide a fixed-point signed integer by another.
19. The MSB of a 16-*bit normalized floating-point number* represents its sign. The least significant 9-bit represents the mantissa. The remaining 6-bit expresses the exponent. How -1.6×10^3 will be written in this system? What is the value of the number whose representation is $(1300)_{16}$?
20. A quadratic equation $x^2 + (10)_r x + (31)_r = 0$, written in radix r, has +ve integral roots. Determine r.
21. What do you mean by fixed-point representation and floating-point representation?
22. What are the value of the IEEE-754 numbers $(a_{31} \ldots a_1\ a_0)_2$ and $(a_{63} \ldots a_1\ a_0)_2$? Convert the IEEE-754 numbers 3F800000 and CF800000 into their decimal equivalent.

23. Express the binary number $(1001)_2$ to Hamming Code? How can it rectify transmission error?
24. Define *literal*, *sum-term, product-term, Conjunctive Canonical Form, Disjunctive Canonical Form, fundamental product term, fundamental sum term and hyper-cube.*
25. Write down the basic postulates (Huntington postulates) of Boolean algebra. What is duality?
26. Verify whether the Boolean function $\sum(1, 3, 5, 7)$ is a self-dual function.
27. State and prove the DeMorgan's theorems for *n* variables.
28. A Boolean function *f(x, y, z)* is realized using NAND gates only. Now all the NAND gates are replaced by NOR gates to realize the function *g(x, y, z).* Can you relate this function with *f(x, y, z)* ?
29. Design a one-bit full Adder-Subtractor block using *ten NAND* gates only.
30. Find the optimized product of sum form of $\sum(0\text{-}3, 6, 8.10\text{-}12)$ using K-map.
31. Show that a Multiplexer is a functionally complete circuit.
32. What are the advantages and disadvantages of *k*-map method over the algebraic method?
33. Show that NAND Gate is Universal Gate.
34. What is an Assembly Language?
35. "The inhibition operator is neither commutative nor associative"-Prove or Disprove
36. Show that a positive-logic AND gate is a negative-logic OR gate.
37. Differentiate between System Software and Application Software.
38. Show that the dual of the exclusive-OR is equal to its complement.
39. A *majority gate* is a digital circuit whose output is equals to 1 if the majority of the inputs
    are 1's.The output is 0 otherwise. By means of a truth table, find the Boolean function
    implemented by a 3-input *majority gate*. Simplify the function.
40. Check whether the given switching function $f = \sum (1, 3, 5, 7)$ is a self-dual and self-
    complementary function.
41. Show that the 1's complement of the excess-3 representation of a BCD number is equal to
    the excess-3 representation of the 9's complement of the same number.
42. State the Idempotent Law of Boolean Algebra

43. What do you mean by Propagation Delay?

44. $(110111)_2 + (100110)_2 + (10101)_2 + (111011)_2 = (?)_{Gray}$

45. Find the complement of the following Boolean Functions and reduce them to a minimum number of literals:
$(BC' + A'D)(AB' + CD')$

46. Prove that the sum of all minterms of a Boolean Function of 3 variables is 1

47. Prove that the possible Boolean Functions that can be formed with n binary variables are 2^{2^n}.

48. Express the following function in (i) sum of products and (ii) product of sums

$F(x, y, z) = x'z' + y'z' + yz' + xyz$

49. Implement the following function with either NAND or NOR gates. Use only four gates. Only the normal inputs are available.

$F = w'xz + w'yz + x'yz' + wxy'z$

$d = wyz$

50. What is the advantage of using octal and hexadecimal number system over binary?

51. What is the relation between Machine Language & Assembly Language?

52. A Boolean function *f(x, y, z)* is realized using NAND gates only. Now all the NAND gates are replaced by NOR gates to realize the function *g(x, y, z).* Can you relate this function with *f(x, y, z)?*

53. Check whether the given switching function $f = \sum (1, 3, 5, 7)$ is a self-dual and self-complementary function.

54. What are the advantages and disadvantages of *k*-map method over the algebraic method?

55. Determine the base b of a number such that $(230)_b$ is equal to $(90)_{10}$

56. Covert $(C4F.B)_{16}$ and $(EB4.5)_{16}$ to binary. Subtract the larger value from the smaller one using 2's complement method and the express your answer in base 10.

57. Perform the arithmetic operation on 8-bit numbers using signed 2's complement

notation: -25+75

58. Simplify the Boolean Function:

$F(w,x,y,z)=\sum(1,3,7,11,15)$

and the don't care conditions

$D(w, x, y, z) = \sum (0, 2, 5)$

and then realize the optimized function using only NAND Gates.

59. Differentiate between Interpreter and Compiler?

60. Define 'min-term' of a Boolean expression.

61. Perform the BCD addition for the following decimal numbers:

448,489

62. Add $(0101)_2$, $(1010)_2$, $(0111)_2$, $(0011)_2$

63. $(E7C.B)_{16}= (?)_8$

64. Divide $(110110000001)_2$ by $(101)_2$

65. Given the Boolean Function $F=xy+x'y'+y'z$

i) Implement it with AND, OR and NOT gates

ii) Implement it with only OR and NOT gates

iii) Implement it only AND and NOT gates

66. Minimize the following Logic Function and realize using NAND Gates only.

$f(A,B,C,D)=\sum m(1,3,7,11,15)+d(0,2,5)$

67. Represent the Decimal Number 8620 in (i) BCD, (ii) Excess-3 Code

68. Demonstrate the nonassociativity of the NOR operator (Both Algebraically and Diagrammatically)

69. Implement the following function with either NAND or NOR gates. Use only four gates. Only the normal inputs are available.

$F= w'xz + w'yz + x'yz' + wxy'z$

$d= wyz$

70. what do you mean by exponent and mantissa? Give example.
71. Explain weighted code and non-weighted code.

72. Compare and Contrast 1's Complement method and 2's complement method of Subtraction
73. Explain Reflected Code. Why it is so named?
74. What is the importance of binary number system in building computers?
75. What is the largest positive number one can represent in 5-bit 2's complement code?
76. Which digit is the least significant digit of a number? Which digit is the most significant digit of a number?

77. When converting a decimal number to binary with repeated division, does the remainder from your first division represent the least significant digit of your answer or the most significant digit of your answer?

78. Briefly describe the ASCII system and explain how it works (i.e. How is it used to represent data.)
79. Explain the ways of representing negative integers in binary?
80. What do you understand by positional number system?
81. What are the ways of converting decimal number into binary, octal and hexadecimal?
82. What do you understand by the term sign and magnitude?
83. What are the three things in representing floating point numbers in binary form. Give an example.
84. What is the advantage of 2's complement over 1's complement.
85. How will you determine parity check for ASCII codes?
86. Write the steps for converting hexadecimal number to octal.
87. Write the steps for converting decimal number to binary using direct method.
88. What is repeated division method .Write down the steps for the same.
89. What is the importance of hexadecimal presentation of number in designing chips?
90. What do you understand by computer codes?
91. Write short notes on ASCII, ISCII, Unicode.
92. Convert the following decimal numbers to its binary equivalent.
    a) 25555.654

b) 45.662

c) 1.567

93. Bulid an XOR Gate using only i) 2-input NAND Gate ii) 2-input NOR Gate

94. $(2E03)_{16}+ (425A)_{16}-(16E9)_{16}= (?)_2$

95. What do you mean by Binary codes? Explain BCD code with examples. Why is it called 8421 code?

96. A′B′CD′+AB′C′D′+ABC′D′+A′B′C′D′=C′D′ (A⊕B)′+B′D′ (A⊕B)

97. What is the radix of the numbers if solution to the quadratic equation x^2-10x+31=10 is x=5 and x=8

98. In the following cases, determine the radix *r*:

(1123) r= $(A3)_{16}$

99. Express the following function in (i) sum of products and (ii) product of sums

$F(x, y, z) = x'z'+y'z'+yz'+xyz$

100. With the use of maps, find the simplest form in sum of products of the function F=fg where f and g are given by

f=wxy′+y′z+w′yz′+x′yz′

g= (w+x+y′+z′) (x′+y′+z) (w′+y+z′)