

CHUKA



UNIVERSITY

Knowledge is Wealth (*Sapiential divitia est*) Akili ni Mali

PHYS 372 DIGITAL ELECTRONIC Y3:S2

STREAM BSC PHYSICS and Bed SCI

INSTRUCTIONS

Answer question ONE and other TWO questions

QUESTION ONE (30 MARKS)

- a) Convert the following numbers into their equivalent binary numbers:
(67DEF)₁₆ (ii) (567.54)₈ (4 marks)
- b) State De Morgan's Theorem (3 marks)
- c) Perform the following operation in binary. (6 marks)
(i) 100101011.001 – 10100110.01
(ii) (4096)₁₀ + (256)₁₀
(iii) (110010)₂ x (1011)₂
- d) Decode the following BCD numbers: (4 marks)
(i) 0111000000010010
(ii) 0101000101010000
- e) Using the theorems of Boolean algebra, prove the following identities: (5 marks)
 $(A + A \cdot B) \cdot (A \cdot C + A \cdot C \cdot (A + B)) \cdot (B + C) = A \cdot B + A \cdot C$
- f) Draw the truth table of a Boolean function given below: $F = A \cdot B + C$ (3 marks)
- g) Using K-map simplify following Boolean function of four variables. (4 marks)
 $F(A, B, C, D) = \sum(0, 1, 2, 4, 7, 9, 11, 12)$

QUESTION TWO (20 MARKS)

- a) Convert the following octal numbers into their binary equivalent:
(i) $(2535)_8$
(ii) $(BD)_{16}$ (4 marks)
- b) Find the gray equivalent of the binary number: $(1000100100111)_2$ and the binary equivalent of gray number $(1010111010000101110)_g$ (4 marks)
- c) Solve the following: (i) $(110010)_2 \times (1011)_2 =$ (4 marks)
- d) Construct 7 –bit even parity Hamming code for transmitting the following digital data: 0110 (4 marks)
- e) Add 876 and 704 in excess–3 code. (2 marks)
- f) Convert the following BCD (8421) code numbers to decimal numbers: (2 marks)
(i) 1001100000000001

QUESTION THREE (20 MARKS)

- a) Convert the following decimal numbers to gray code:
i) 8975 (2 marks)
- b) Convert the following decimal number to XS3 (excess –3) code: 4415 (2 marks)
- c) Convert the following decimal numbers to 2421 code numbers: 8474 (2 marks)
- d) Prove that the NAND operation for three variables is not associative.
 $A \uparrow (B \uparrow C) \neq (A \uparrow B) \uparrow C$ (4 marks)
- e) Express the following function into canonical form: (2 marks)
 $G = A \cdot B \cdot C + A \cdot B + B \cdot C$
- f) What is the difference between the ordinary algebra and Boolean algebra? (4 marks)
- g) Convert the decimal number 543294 into its equivalent number in base 3 and base 5. (4 marks)

QUESTION FOUR (20 MARKS)

a) Using the Venn diagram prove the following identities: $X + Y = X \cdot Y$ (4 marks)

b) Simplify the following functions using the theorems Boolean algebra. (4 marks)

(i) $F(a, b, c, d) = \sum(0, 1, 2, 8, 9, 10)$

c) Express the following function into canonical form: $G = A \cdot B \cdot C + \bar{A} \cdot B + \bar{B} \cdot C$ (4 marks)

d) Express the following Boolean function in PS form $G = A \cdot B \cdot C + \bar{A} \cdot B + \bar{B} \cdot C$

e) Simplify the following functions using the theorems Boolean algebra.

$F(X, Y, Z, W) = \prod(0, 1, 2, 3, 8, 9, 10, 11, 13, 15)$

f) Using K-map simplify following Boolean function of three variables.

$F(A, B, C) = \sum(m_0, m_1, m_5, m_6, m_7)$ (4 marks)

QUESTION FIVE (20 MARKS)

a) Using K-map, obtain the minimal POS expressions of the following and implement them with NOR gates only

$F(A, B, C, D) = \prod(0, 1, 2, 4, 5, 9, 10, 11, 12, 13, 14, 15)$ (4 marks)

b) Simplify the following functions using the theorems Boolean algebra. (4 marks)

$F(a, b, c, d) = \sum(0, 1, 4, 6, 9, 13, 14, 15)$

c) Minimize the following function using K-map and realize it with AND, OR & NOT logic gates.

$X(A, B, C, D) = \sum(0, 1, 2, 5, 8, 10, 11, 14, 15)$ (6 marks)

d) Simplify the Boolean function five variables:

$F(A, B, C, D, E) = \sum(0, 2, 3, 4, 6, 7, 8, 11, 12, 13, 16, 18, 19, 20, 22, 23, 24, 27, 28, 29)$ (6 marks)