370

(The *University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

(MMUST) MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2022/2023 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE

OF

BACHELOR OF SCIENCE (COM, SIT, SPA, SME, SMT, SST, EDS, SIK)

COURSE CODE: BIT 111 /BCS 112

COURSE TITLE: DISCRETE STRUCTURES

DATE: 14/12/2022 **TIME: 3.00 – 5.00PM**

INSTRUCTIONS TO CANDIDATES

Answer question ONE (compulsory) and any **TWO** questions

This Paper Consists of 4 Printed Pages. Please Turn Over ▶

QUESTION ONE (30MKS)

a) Given that set A= (a, b, c, d)

i) Find all the total number of subsets of A (3mark)

ii) Determine the power of set A (1mark)

iii) State the cardinality of set A (1mark)

b) Define the following

i) Reflexive relation (2mark)

ii) A binary tree (2mark)

c) Construct circuit that produces the out put $XY + \overline{X}Y$ (1mark)

d) Prove that for every integer x, x(x+1) is even. (5mark)

e) Verify that $\overline{A+B} = \overline{A} \cdot \overline{B}$ using de-morgans laws and the rules of Boolean algebra . (5 marks)

f) Given that $f(x) = 7x - 4$.

i) Find the inverse of $f(x)$, (3marks)

ii) Verify that $f.f^{-1}(x) = x$ (3 marks)

g) Convert 11011_2 to decimal number system (4 marks)

QUESTION TWO (20MKS)

a) Given that set A ={ 1, 2, 3, 6} is related to set B , B={3,4,5, 7 } by relation T={ (1, 3) (1,4)(1,5)(2, 3)(3,3)} and set B is related to set C, C={ 1, 2, 3, 4} by relation Q={ (3,1) (3, 2)(3,3) (4, 3)(4,4} . Find (9 marks)

i) T^{-1}

ii) $(Q^{-1})^{-1}$

iii) $Q \bullet T$

iv) $T \bullet Q$

b) Prove that $5+10+15+...+5n = \frac{5n(n+1)}{2}$ is true for every positive integers (5 marks)

c) Convert 47_{10} to a binary number system (3 marks)

d) Divide using synthetic division $(4x^3 - 2x + 3) \div (x+1)$ (3 marks)

QUESTION THREE (20MKS)

a) Show that $AU(BnC) = (AUB)n(AUC)$ (5 marks)

b) Consider three sets A, B and C . Set A contains a elements, B contains b elements, C contains c elements. Both A and B contains w elements, B and C contains x elements, A and C contains y elements. All the three sets A , B and C contains z elements.

i) Draw the venn diagrams to show the above information
Determine

ii) Number of elements related only to A

iii) Number of elements related only to B

iv) Number of elements related only to C

v) Number of elements related only to A and B

vi) Number of elements related only to A and C

vii) Total number of elements related to all the three sets (10 marks)

c) Find the GCD of 999 and 123 using Euclidean algorithm. (5 marks)

QUESTION FOUR (20MKS)

a) Draw the correct logical gates symbol for the following names (5 marks)

i) AND

ii) NOT

iii) NOR

iv) XOR

v) NAND

b) Devise a logical circuit to meet the requirement of the output given in the table below (8maks)

INPUT			OUTPUT
A	B	C	Z
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

c) Show that $f : R \rightarrow R$ defined as $f(a) = 3a^2 - 4$ is one to one function (3 marks)

d) Given three functions; $f(x) = x$, $g(x) = 2x - 7$, $h(x) = x - 1$. Find $f \bullet (g \bullet h)(-2)$ (4 marks)

QUESTION FIVE (20MKS)

a) Express gcd (500, 222) =2 as a linear combination of 500×222 using Bezouts theorem. (6 marks)

b) A village Baraza consists of 9 men and 12 women, how many ways can a committee consisting of 5 men and 3 women be chosen. (5 marks)

c) By giving an illustration , differentiate between n-cube graphs and complete graphs as used in special graphs (4 marks)

d) Find the optimal Huffman code for the following tableof symbols. (5 marks)

Character	Frequency
A	2
B	3
C	7
D	8
E	12