GRETSA UNIVERSITY - THIKA

UNIVERSITY EXAMINATIONS

JANUARY – APRIL 2026 SEMESTER

BACHELOR OF EDUCATION, COMPUTER SCIENCE

COURSE CODE: BSCS 104

COURSE TITLE: DISCRETE STRUCTURES 2

DATE: 08 APRIL 2026 **TIME: 2 HOURS**

INSTRUCTIONS TO CANDIDATES

1. SECTION A IS **COMPULSORY.**
2. SECTION B: ANSWER ANY OTHER **TWO** QUESTIONS.
3. **DO NOT** WRITE ANYTHING ON THIS QUESTION PAPER AS IT WILL BE AN EXAM IRREGULARITY.
4. ALL ROUGH WORK SHOULD BE AT THE BACK OF YOUR ANSWER BOOKLET AND CROSSED OUT.

CAUTION: *All exam rooms are under CCTV surveillance during the examination period.*

SECTION A: COMPULSORY

QUESTION ONE (30 MARKS)

a) Define the terms 'witness' and 'universe of discourse' as used in quantification. **[4 Marks]**

b) State the truth value of $\exists x P(x)$ in the domain of integers given that P(x)= x^2 ■ 3 **[3 Marks]**

c) Prove that if $n3.\ 5$ is odd then n is odd by contrapositive **[4 Marks]**

d) Prove by mathematical induction that 2 +4 +6+…+2n =n (n+1). **[4 Marks]**

e) Using direct proof show that the product of two odd numbers is odd **[4 Marks]**

f) When a die was thrown, the score was an odd number. What is the probability that it was a prime number **[4 Marks]**

g) Construct a truth table for $\sim p \wedge (p \vee q)$. **[5 Marks]**

h) Differentiate between a graph and a tree **[2 Marks]**

SECTION B: ANSWER ANY TWO QUESTIONS

QUESTION TWO (20 MARKS)

a) Proof by contraposition that if 3n+2 is even, then n is even **[6 Marks]**

b) Let P(x) be the statement "$x.\ 1$ AA x". What is the truth value of the quantification

. $xP(x)$ where the domain is the set of real numbers **[4 Marks]**

c) Define the term spanning tree as used in graphs. **[2 Marks]**

i) Let G be the graph with the following adjacency list

a: b
b: a, c, e
c: b, d, e
d: c e: b, c

ii) Draw graph G **[4 Marks]**

iii) Draw at least 2 spanning trees of G **[4 Marks]**

QUESTION THREE(20 MARKS)

a)

i. State the Bayes' Theorem **[2 Marks]**

ii. A jar contains 3 black marbles and 4 white marbles. A marble is picked at random

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without replacement. What is the probability of getting a black marble the second time given that the first one was also black **[4 Marks]**

b) Solve the recurrence relation $a_n = 10a_{n-1} - 25a_{n-2}$, with initial conditions $a_0 = 3$ and $a_1 = 17$ **[6 Marks]]**

c) State and prove the handshake Lemma **[4 Marks]**

d) Given the following propositional function, determine its true/false value when the variables are set as follows;

C(x, y) ="x is the capital of y"

i. C(Ottawa, Canada) **[2 Marks]**

ii. C(Kampala, Rwanda) **[2 Marks]**

QUESTION FOUR (20 MARKS)

a) Define

i) Mutually exclusive events **[1 Mark]**

ii) Independent events **[1 Mark]**

b) A number is chosen at random from 1,2,3,…,30.Find the probability that

i) It is divisible by 4 **[1 Mark]**

ii) It is divisible by both 3 and **4** **[2 Marks]**

iii) It is divisible by 4 given that it's divisible by 3 **[2 Marks]**

c. Let D be the graphs with the following adjacency list

1:2, 3

2:1, 4

3:1, 4

4:2, 3

5:3, 6

6:5

iv) Draw this graph, D **[4 Marks]**

c) Find and draw all spanning trees Events T and R are such that the probability of $T' = 3/5$ P($R \mid T'$)= 1/3 while P

R' / T ●

$\frac{1}{4}$ Evaluate.

i. P(R) **[4 Marks]**

ii. P(T′/R) **[4 Marks]**

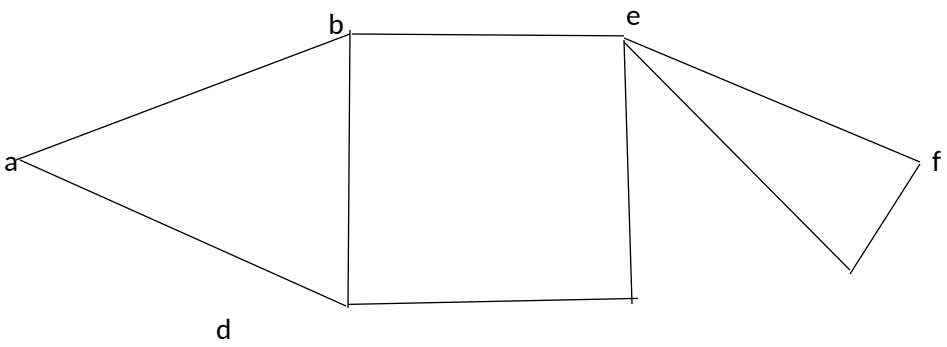
QUESTION FIVE (20 MARKS)

a) What do you understand by the following terms as used in graphs.

i. Circuit **[1 Mark]**

ii. Path **[1 Mark]**

b) Given the following graph



Using the graph, find

i) A trail from b to d **[2 Marks]**

ii) A circuit from b to b **[2 Marks]**

iii) The adjacency matrix. **[3 Marks]**

c) Consider A= $\begin{pmatrix} 4 & -1 & 1 \\ -3 & 4 & 5 \\ 2 & 3 & 2 \end{pmatrix}$; Evaluate,

i. |A|. **[2 Marks]**

ii. $M_{12,}\, a_{23}\, ¿\, A_{23}$ **[3 Marks]**

iii. A^{-1} **[5 Marks]**