

CHUKA



UNIVERSITY

RESIT/SPECIAL EXAMINATIONS

**EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN
COMPUTER SCIENCE AND APPLIED COMPUTER SCIENCE**

COSC 102: DISCRETE STRUCTURES

STREAMS

TIME: 2 HOURS

DAY/DATE: WEDNESDAY 05/05/2021

11.30 A.M – 1.30 P.M

INSTRUCTIONS:

- Answer **QUESTION 1** and any other **TWO QUESTIONS** from section B.
- This is a **CLOSED BOOK EXAM**, No reference materials allowed in examination room.
- Do not write on this question paper
- No use of mobile phones
- Write your answers legibly and use your time wisely.
- Scientific, non-programable Calculators may be used.

SECTION A: COMPULSORY

QUESTION 1[30 MARKS]

- a) What is proposition, Give examples? [4 marks]
- b) Discuss proof by contradiction [4 marks]
- c) Give two areas in computer science where proof is useful [2 marks]
- d) Suppose there are 50 people in a room, how many of them must have their birthday in the same month? [4marks]
- e) Each User on a computer system has a password which must be six to eight characters long.
Each character is an uppercase letter or digit.
Each password must contain at least one digit.
How many passwords are there? [6marks]

- f) Suppose variable names in a given programming language can be either a single uppercase letter or an uppercase letter followed by a digit, find the number of possible variable names [4marks]
- g) How many bit strings of length 8 either start with a 1 or end with two bits 00?
[2marks]
- h) Suppose a list A contains the 30 students in a mathematics class, and a list B contains the 35 students in an English class, and suppose there are 20 names on both lists. Find the number of students:
(i). Only on list A, (ii) only on list B, (iii) on list A or B (or both), (iv) on exactly one list. [4marks]

SECTION B: ANSWER ONLY TWO QUESTIONS FROM THIS SECTION

Question 2 [20marks]

With the use of direct proof or otherwise, prove the following:

- (a) The square of an even natural number is even [6marks]
- (b) The square of an odd natural number is odd [4marks]
- (c) The claim that if n is a positive integer, then the quantity n^2+3n+2 is even [4mks]
- (d) With the use of relevant examples, discuss proof by induction [6marks]

Question 3 [20marks]

- (a) Find the number of permutations of six objects, {A,B,C,D,E,F} taking three at a time [8marks]
- (b) A farmer buys 3 cows, 2 pigs and 4 hens from a man who has 6 cows, 5 pigs, and 8 hens. Find the number of choices the farmer has to make [12marks]

Question 4 [20marks]

- (a) Let M , P and C be the sets of students taking Mathematics, Physics and Computer courses respectively in Chuka University. Take $|M| = 300$, $|P| = 350$, $|C| = 450$, $|M \cap P| = 100$, $|M \cap C| = 150$, and $|P \cap C| = 75$, $|M \cap P \cap C| = 10$. Determine the number of students taking exactly one of the above courses.

[12marks]

- (b) Joan is either a knight or a knave (not both). Knights always tell the truth, and only the truth; Knaves always tell lies, and only lies. Someone asks Joan, “Are you a knight?” She replies, “If I am a knight then I will eat my hat.” Determine the type Joan is and whether she will eat her hat.

[8marks]

Question 5 [20marks]

- (a) The symmetric difference of two sets, A and B , is the set defined by $(A \setminus B) \cup (B \setminus A)$. Draw a Venn diagram to show this difference. [6marks]

- (b) The difference of A and B , is the set of all elements that belong to A but not to B . Use Venn diagram to demonstrate this difference. [6marks]

- (c) For each of the sets A and B below, find $A \cup B$ and $A \cap B$ [8marks]

(i) $A = \{3, 2, a\}$, $B = \{2, 3, a\}$

(ii) $A = \{4, 7, -1\}$, $B = \{7, 3, 4\}$