CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF
BACHELOR OF SCIENCE IN COMPUTER SCIENCE, BACHELOR OF SCIENCE, BACHELOR OF SCIENCE APPLIED COMPUTER SCIENCE

COSC 102: DISCRETE STRUCTURES

STREAMS: BSC (COMP SCIE) **TIME: 2 HOURS**

DAY/DATE: MONDAY 06/04/2020 **11.30 AM – 1.30 PM**

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. No use of mobile phones not allowed.
- Do not write on this question paper
- Write your answers legibly and use your time wisely.
- Scientific, non-programable Calculators may be used.

SECTION A: COMPULSORY

QUESTION 1[30MKS]

a) What is a proposition? Give examples [4mks]

b) Explain the type of problems that can be solved in Discrete math. [4mks]

c) State the Converse, the inverse and the Contrapositive of the following conditional statement:

"The home team wins, wherever it is raining" [4mks]

d) Construct the Truth table of the following compound proposition $(p \vee -q) \longrightarrow (p \wedge q)$ [6mks]

e) Given that variable names in a programming language can be either a single uppercase letter or an uppercase letter followed by a digit, find the number of possible variable names [4mks]

f) The members of the set S = {x | x is the square of an integer and x < 100} list the members. [4mks]

g) 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. [4mks]

SECTION B: ATTEMPT ONLY TWO QUESTIONS FROM THIS SECTION

Question 2 [20mks]

a) Let A, B and C be sets. Prove or disprove (with a counter example) each of the following:
(i) If $A/C=B/C$ then $A=B$
.
(ii) If $[(A\cap C=B\cap C)\&(A/C=B/C)$ then $A=B$
.
(ii) If $[(A\cup C=B\cup C)\&(A/C=B/C)$ then $A=B$. [6mks]

b) With the use of direct proof or otherwise, prove the following:
(i). The square of an even natural number is even [4mks]
(ii).The square of an odd natural number is odd [4mks]
(iii). The claim that if n is a positive integer, then the quantity $\mathbf{n^2+3n+2}$ is even [2mks]

c) With the use of relevant examples, discuss proof by induction [4mks]

Question 3[20mks]

(a) Find the number of permutations of six objects, {A,B,C,D,E,F} taking three at a time [4mks]

(b) Prove by direct proof or otherwise, that the sum of two odd numbers is even. [4mks]

(c) A farmer buys 3 cows, 2 pigs and 4 hens from a man who has 6cows, 5pigs, and 8 hens. Find the number of choices the farmer has to make [12mks]

Question 4[20mks]

(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∩P| = 100, |M∩C| = 150, and |P∩C|=75, |M∩N∩P∩C| =10. Determine the number of students taking exactly one of the above courses. [6mks]

(b) How many ways are there to select five players from a 10-member tennis team to make a trip to a match at another school? [6mks]

(c) What is the minimum number of students required in a discrete mathematics class to be sure that at least six will receive the same grade, if there are five possible grades, A, B, C, D, and F? [4mks]

(d) An highland has two kinds of inhabitants, knights and knaves. Knights always tell the truth, and only the truth; Knaves always tell lies, and only lies. John encountered two people on his visit to the highland, A and B. Determine what is A and B if A tells John " B is a Knight" and B "says The two of us are of opposite type" [4mks]

Question 5 [20mks]

(a) Find the number M of seven letter words that can be formed using the word "BENZENE". [8mks]

(b) Use Binomial theorem to Determine the coefficient of $x^{12}y^{13}$ in the expansion of $(x+y)^{25}$ [4mks]

(c) Determine the expansion of $(x+y)^4$ using Binomial theorem [4mks]

(d) State the pigeonhole principle. [4mks]
