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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2020 /2021 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE COMPUTER SCIENCE

COURSE CODE: COM 113

COURSE TITLE: MATHEMATICS FOR COMPUTER SCIENCE

DATE: 23RD FEBRUARY, 2021 **TIME: 9AM – 12.00 NOON**

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 4 PRINTED PAGES PLEASE TURN OVER

REGULAR – MAIN EXAM

COM 113: MATHEMATICS FOR COMPUTER SCIENCE

STREAM: BSc (CS) DURATION: 3 Hours

INSTRUCTION TO CANDIDATES

i. *Answer **ALL** questions from **section A** and any **THREE** from **section B***

ii. *Do not write on the question paper.*

SECTION A (31 marks)

QUESTION ONE 16MKS

a. What do you understand by the following symbols:- [4mks]

i. $\exists$

ii. Z

iii. Q

iv. $(A^c)^c$

b. Given the alphabet $\in = \{a, b\}$ Define a language L_1 over $\in$ to be a set of all strings that begin with the character a and have a length of at most four characters. [4mks]

c. Explain using examples the following laws of sets: - associative law and commutative law.

[4mks]

d. Explain four properties of an empty set. [4mks]

QUESTION TWO 15MKS

a) Define the following terms
   i) Inverse of a function [1mk]
   ii) Quantifier [1mk]
   iii) Rational number [1mk]
   iv) Domain [1mk]
   v) Open sequence [1mk]

b) State the principle of mathematical induction [3mks]

c) Let A = Z the set of integers and let R be define by R b if and only if $a \leq b$. is R an equivalence relation [3mks]

d) Briefly explain the following

i) Symmetric relation [2mks]

ii) Equivalence relation [2mks]

SECTION B (39 marks)

QUESTION THREE 13MKS

a. Let A = {1, 2} and B= {1, 2, 3} and define a binary relation R from A to B as follows:- Given any (x, y) Є A x B, (x, y) Є R ↔ x-y is even.

i. State which ordered pairs that are in A x B, which are in R and examine each [6mks]

ii. Graph Ax B by plotting all the points of A x B in the Cartesian plane and cycling points that are in R. [4mks]

b. When is a collection of non-empty set said to be a partition? State the conditions. [3mks]

QUESTION 4 [13 MKS]

a. Let a_1, a_2, a_3 …. b_1, b_2, b_3… All satisfy the recurrence relation that the *k*th term equals 3 times the (k-1)st term for all integers $k \geq 1$:

$a_k = 3a_{k-1}$, $b_k = 3b_{k-1}$, $c_k = 3c_{k-1}$. But suppose the initial condition was $a_1=0$, $b_1=1$ and $c_1=2$. Find:-

i. a_2, a_3 a_5. [3mks]

ii. b_2, b_3, b_4. [3mks]

b. Show that the sequence 1, -1!, 2!, -3!, ……$(-1)^n n!$…. for $n \geq 0$, satisfies the recurrence relation $s_k = -k.s_{k-1}$ for all integers $k \geq 1$. [7mks]

QUESTION 5 [13 MKS]

a. Draw a binary tree to represent the expression ((a-b).c+ (d/e). [4mks]

b. Explain the following terms: - reflexive, transitive and symmetric. [6mks]

c. Give the equivalent ordered tuple of $(4, (-3)^2, ½))$ [3mks]

QUESTION 6 [13 MKS]

a. New sets can be defined in terms of known ones. Given a set S and a predicate P(x) defined for x in S there is a set A whose elements are exactly those elements of S for which P(x) is true.

   i. What is the name of this principle? [2mks]

   ii. Write the statement above using symbols. [4mks]

b. Let A= {0,1,2,3} and consider the relation R defined on A as follows:-

   R = {(0,1) (1,2) (2,3)}. Find the transitive closure of R and draw a directed graph. [7mks]

QUESTION 7 [13 MKS]

a. Let p be the set {a, b, c, d, e, f, g}, let A = {b, c, e, g} and B = {d, e, f, g}. Find AUB, A∩B and A^c and draw the Venn diagram for the representations. [7mks]

b. Define the following: prefix notation, infix notation and postfix notation. [6mks]

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