JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEMS

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE ACTURAL SCIENCE

3rd YEAR 2nd SEMESTER 2017/2018 ACADEMIC YEAR

MAIN CAMPUS

COURSE CODE: SCS 318

COURSE TITLE: DESIGN AND ANALYSIS OF ALGORITHM

EXAM VENUE: LAB 2ND FL

STREAM: (BSc. Actuarial)

DATE: 26/04/2017

EXAM SESSION: 9.00 – 11.00 AM

TIME: 2.00 HOURS

INSTRUCTIONS:

1. Answer Question 1 (Compulsory) and ANY other two questions
2. Candidates are advised not to write on the question paper
3. Candidates must hand in their answer booklets to the invigilator while in the examination room

QUESTION ONE 30 MARKS

a) What is an algorithm? State any two reasons why we study algorithms.(4 Marks)

b) Give three ways you can describe an algorithm and state atleast one advantage of each. (6 Marks)

c) Using an example Clearly distinguish between a program and an algorithm. (4 Marks)

d) Algorithm growth rates normally follow specific functions, describe the three categories of functions; polynomial, exponential and logarithmic functions. Compare their growth rates using suitable sample data. (8 Marks)

e) Describe four charecteristics of an algorithm. (4 Marks)

f) Mention at least four components of an algorithm. (4 Marks)

QUESTION TWO 20 MARKS

a) Clearly distinguish between iterative and recursive algorithms. (6 Marks)

b) A polynomial of degree n is a function $p_n(x) = \sum_{i=0}^{n} a_i x^i$. Assuming n = 2, 3, 4 and 5, expand the polynomial function above and state its time complexities for each of the given four values of n. (6 Marks)

c) The factorial function n! has value 1 when $n \le 1$ and value n*(n-1)! when n >1. Write both a recursive and an iterative algorithm to compute n! (8 Marks)

QUESTION THREE 20MARKS.

a) From first principles, determine the Big O the time complexities for the following functions

i. $T(n) = n^2+2n+4$ (3 Marks)

ii. $T(n) = 2n^4+4n$ (3 Marks)

b) You are required to sort into alphabetical order using merge sort algorithm the following array of marks for ten students, {60,58,49,70,88,55,40,65,68,80}. Explain the steps involved and deduce its time complexity. (10 Marks)

c) Write an iterative algorithm for computing $S=\sum_{i=1}^{i=n} i^2$ (4 Marks)

$S = \sum_{i=1} i^2$

QUESTION FOUR 20MARKS

a) Describe the divide and conquer technique and give an example of a problem solveable using such a technique . (6 Marks)

b) Describe the Towers of Hanoi problem. (4 Marks)

c) State the algorithm for solving the Towers of Hanoi problem. (4 Marks)

d) Using a suitable example, explain how you would determine the efficiency of two algorithms for the same problem. (6 Marks)

QUESTION FIVE 20 MARKS

a) Mark is driving around the one- way system in Nairobi. The following table shows the times, in minutes for Mark to drive between four places: *A, B, C* and *D*. Mark decides to start from *A*, drive to the other places and then return to *A*. mark wants to keep his driving time to minimum.

FROM \ TO	A	B	C	D
A	-	8	6	11
B	14	-	13	25
C	14	9	-	17
D	26	10	18	-

i) Find the length of the tour *ABCDA* (2 Marks)

ii) Find the length of the tour *ADCBA* (2 Marks)

iii) Find the length of the tour using the nearest neighbor algorithm starting from *A* (4 Marks)

iv) Write down which of your answers to parts (a), (b) and (c) gives the best upper bound for Mark's driving time (2 Marks)

b) Molly is taking part in a treasure hunt. There are five clues to be solved and they are at the points *A, B, C, D and E.* The table below shows the distances between pairs of points. All of the distances are functions of *x*, **where *x* is an integer.**

Molly must travel to all five points, starting and finishing at **A**.

	A	B	C	D	E
A	-	$x + 6$	$2x - 4$	$3x - 7$	$4x - 14$
B	$x + 6$	-	$3x - 7$	$3x - 9$	$x + 9$
C	$2x - 4$	$3x - 7$	-	$2x - 1$	$x + 8$
D	$3x - 7$	$3x - 9$	$2x - 1$	-	$2x - 2$
E	$4x - 14$	$x + 9$	$x + 8$	$2x - 2$	-

a) The nearest point to A is C.

i) By considering AC and AB, ***shows that*** $x < 10$. (2 Marks)

ii) Find two other inequalities in x. (2 Marks)

b) The nearest neighbor algorithm, starting from A, gives a **unique** minimum tour ***ACDEBA.***

i) By considering the fact that Molly's tour visits D immediately after **C,** find two further inequalities in x. (2 Marks)

ii) Find the value of integer x. (2 Marks)

iii) Hence find the total distance travelled by Molly if she uses this tour. (2 Marks)