# CHUKA UNIVERSITY

**UNIVERSITY EXAMINATIONS**

**CHUKA AND THARAKA CAMPUSES**

**FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE (ACTUAL SCIENCE)**

**ACMT 111: COMPUTATIONAL METHOD AND DATA ANALYSIS I**

**STREAMS:** **TIME: 2 HOURS**

**DAY/DATE: WEDNESDAY 08/04/2020** **2.30 P.M. – 4.30 P.M.**

**INSTRUCTIONS**

- **Answer questions ONE (compulsory) and any other TWO questions**

**QUESTION ONE (30 MARKS)**

a) Following is a table of values for f(x) = tan x for a few values of x

| x | 1 | 1.1 | 1.2 | 1.3 |
|---|---|---|---|---|
| tan x | 1.5574 | 1.9648 | 2.5722 | 3.6021 |

Use linear interpolation to estimate tan (1.15).

(5 marks)

b) A statistical survey is implemented according to a series of steps each of which includes a specific and defined set of formats and procedures. Highlight eight such of statistical survey implementation (4 marks)

c) Consider the function

$$U(x) = x^2$$

Find the first order forward finite difference approximation to $U_X(3)$using step size h = 0.1

(5 marks)

d) Given a relative error r.e. = 0.5, how many significant digits do we have?

(3 marks)

e) State five important uses of Statistical Package for Social Science in modern days data analysis

(5 marks)

f) Discuss three type of error commonly used in numerical computations

(3 marks)

g) Explain five importance use of the advanced technology in complex data analysis

(5 marks)

**QUESTION TWO (20 MARKS)**

a) Using finite difference method solve the following differential equation

$$\frac{d^2\,x(t)}{dt^2} + x(t) = 0$$

$$With\ x(o) = 1\ and\ x(0) = 0$$

(10 marks)

b) By finite difference approximate the solution of the initial-value problem

$$y'' - \left(1 - \frac{x}{5}\right) y = x$$

$$y(1) = 2\ and\ y(3) = -1$$

on the interval $1 \leq x \leq 3$.

(10 marks)

**QUESTION THREE (20 MARKS)**

a) Define databases

(2 marks)

b) Describe six purposes of databases system in modern day society

(6 marks)

c) Describe the importance of data integrity, security, andprivacy and how they affect database design.

(8 marks)

d) State four areas where databases are mostly applicable

(4 marks)

**QUESTION FOUR (20 MARKS)**

Approximate the solution of the nonlinear ordinary differential equation

$$8y'' + yy' = 2x^3 + 32$$

Where *y(1) = 17* and *y(4) =45*

(20 marks)

**QUESTION FIVE (20 MARKS)**

a) Consider the following tables of functions values generated with *f(x) = inx*

| i | $x_i$ | $f_i$ |
|---|---|---|
| 0 | 0.40 | -0.916291 |
| 1 | 0.50 | -0.693147 |
| 2 | 0.70 | -0.356675 |
| 3 | 0.80 | -0.223144 |

Find *g(0.60)* (10 marks)

b) Refer to the data in the following table. Interpolate the data from x = 1 to 10 at increments of 0.5 using linear interpolation. Plot the interpolated values and data together using each of the following methods (create a new plot with the data for each method). Label your axis on the plots.

| x | 1 | 2 | 3 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|---|---|
| y | 2 | 2.5 | 7 | 10.5 | 12.75 | 13 | 13 |

Use a 3rd order Lagrange interpolating polynomial to predict y at x = 1.25 for the following data

| x | y |
|---|---|
| 1 | 0.14 |
| 1.1 | 0.21 |
| 1.2 | 0.33 |
| 1.3 | 0.54 |
| 1.4 | 0.92 |

(10 marks)

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