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KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2023/2024 ACADEMIC YEAR
THIRD/FOURTH YEAR, SECOND/FIRST SEMESTER EXAMINATION
FOR THE BACHELOR OF SCIENCE IN COMPUTER SCIENCE
KCS 311 – SCIENTIFIC COMPUTING

Date: 10TH AUGUST 2023
Time: 11:30AM – 1:30PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) Define scientific computing: (2 Marks)

b) Based on your understanding, explain what is made by development of algorithm and analysis of algorithm (4 Marks)

c) Differentiate between absolute error and relative error. (4 Marks)

d) A Fibonacci sequence of integers can be generated given the largest number in the series. Develop and explain a simple algorithm for generating this sequence. (6 Marks)

e) There are two types of arithmetic operations available in a computer. Integer arithmetic and floating point arithmetic. Briefly explain them. (6 Marks)

f) There are two reasons which can cause and error to occur in numerical calculations. Name them. (2 Marks)

g) Compute the value of $(x^2 - y^2)(x + y)$ with $x = .4845$ and $y = .4800$, using normalized floating point arithmetic. Compare the value of (x-y) and determine the relative error of the former. (6 Marks)

QUESTION TWO (20 MARKS)

a) Obtain an algorithm which given the coordinates of a point(x,y) will write a message or display a message whether it is in the first quadrant of the unit circle. (10 Marks)

b) Find the absolute and relative errors of the approximation 125.67 to the value 119.66. (4 Marks)

c) Explain the following classification of absolute error.
   i) Absolute accuracy error
   ii) Absolute mean error
   iii) Absolute precision error (6 Marks)

QUESTIONS THREE (20 MARKS)

a) Given the following quadratic equation $f(x) = x^3 - 2.5x^2 - 2.46x + 3.96 = 0$. Compute the values of f(x) given x values as tabulated below. (10 Marks)

x	***-2***	***-1***	***0***	***1***	***2***
f(x)					

b) Using an iterative method of solving quadratic equation, develop an algorithm to tabulate the values of ***f(x)*** given the minimum and maximum values of ***x.*** (10 Marks)

QUESTION FOUR (20 MARKS)

a) Study of scientific computing is very important, state and explain any two reason for studying scientific computing. (4 Marks)

b) Obtain an algorithm to add two numbers using normalized floating point arithmetic. Assume a 4 digit mantissa and a 2 digit exponent and that each number is presented in the form (x,y) where x is the mantissa and y the exponent. (8 Marks)

c) Explain the difference between the following terms as used in numerical computation.

i) Truncation errors and rounding off errors (4 Marks)

ii) Exponent and Mantissa (4 Marks)

QUESTION FIVE (20 MARKS)

Consider the following simultaneous equation.

$$2.5x_1 + 5.5x_2 = 6.2$$

$$1.251x_1 + 2.605x_2 = 3.152$$

a) Solve the equations by Gauss elimination using floating point arithmetic and get your answer in 4 significant digits. (10 Marks)

b) Using iterative refinement, improve your solution in (i) above. (10 Marks)