MACHAKOS UNIVERSITY

University Examinations for 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCE

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

SECOND YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (SCIENCE IN COMPUTER SCIENCE

SCO213: NUMERICAL ANALYSIS FOR COMPUTER SCIENCE

DATE: 25/7/2019 **TIME: 11.00-1.00 PM**

INSTRUCTIONS

ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS

QUESTION ONE COMPULSORY (30 MARKS)

a.) If 0.182 is the approximate value of $\frac{2}{11}$ find the absolute, relative and percentage errors.

(4 marks)

b.) Construct the forward difference table, where $f(x)=\frac{1}{x}, x=1(0.2)2,4D$ (4 marks)

c.) For the following table of values, estimate $f(7.5)$, using Newton's backward difference interpolation formula (5 marks)

d.) If $f(x)$ is a polynomial of n^{th} degree in x , then $\Delta f(x)$ is a again a polynomial of degree $n-1$ (5 marks)

e.) Set up Newton iteration for computing the square root of a given positive number. Using the same find the square root of 2 exact to six decimal places. (6 marks)

f.) Find a root of the equation $x^3+x^2-1=0$ on the interval $[0,1]$ with an accuracy of 10^{-4}

(6 marks)

QUESTION TWO (20 MARKS)

a.) Show that the operators Δ and E commute. (2 marks)

b.) Solve $x^3 - 9x + 1 = 0$ for the root between $x = 2$ and $x = 4$, by bisection method. (5 marks)

c.) Solve the equation $x^3 = Sinx$. Considering various $\phi(x)$, discuss the convergence of the solution. (5 marks)

d.) How accurately should the length and the time of vibration of a pendulum should be measured in order that the computed value of g be correct to 0.01% (8 marks)

QUESTION THREE (20 MARKS)

a.) Deduce the error in quotient and its absolute error (4 marks)

b.) Using Aitken's scheme and the following values evaluate $\log_{10} 301$

x	300	304	305	307
$\log_{10} x$	2.4771	2.4829	2.4843	2.4871

(5 marks)

c.) Find the cubic polynomial which takes the following values; $f(1) = 24,\ f(3) = 120,\ f(5) = 336,$ and $f(7) = 720.$ hence or otherwise, obtain the value of $f(8).$ (5 marks)

d.) Evaluate $\int_0^1 e^{-x^2} dx$ by means of Trapezoidal rule with $n = 10$ (6 marks)

QUESTION FOUR (20 MARKS)

a.) Find the polynomial of lowest degree which assumes the values 10,4,40,424 and 620 at $x = -2,1,3,7$ and 8. (6 marks)

b.) Construct the difference table for the following data and locate the error in the second column.

x	3.6	3.61	3.62	3.63	3.64	3.65	3.66	3.67	3.68

$f(x)$	0.112046	0.120204	0.128350	0.136462	0.144600	0.152702	0.160788	0.168857	0.176908

(7 marks)

c.) Find the interpolating polynomial by Newton's divided formula for the following table and then calculate $f(2.1)$.

x	0	1	2	4
$f(x)$	1	1	2	5

(7 marks)

QUESTION FIVE (20 MARKS)

a.) Derive the Newton-Raphson iterative formula

$$x_n = x_{n-1} - \frac{f(x_{n-1})}{f'(x_{n-1})}, n \geq 1$$

For the solution of the non-linear equation $f(x) = 0$. (10 marks)

b.) Use the method in a.) to find the root of the equation $\tan x = x$ near $x = 4.5$ correct to four decimal places. (10 marks)