



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

SECOND YEAR SPECIAL/SUPPLEMENTARY EXAMINATIONS FOR
BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCO 213: NUMERICAL ANALYSIS

DATE: 23/9/2019

TIME: 11:00 – 1:00 PM

INSTRUCTION: Attempt question ONE and any other TWO questions

QUESTION ONE

- i. Estimate the error in z if $z = \frac{x}{y} + 2x$ given that $x = 3.213$ and $y = 6.172$ (3 marks)
- ii. Show that:
- a) $2\mu\delta = \Delta + \nabla$ (3 marks)
- b) $\delta^2 = \Delta\nabla = \Delta - \nabla$ (3 marks)
- iii. Starting with $x_0 = 3$, find an approximate root of $f(x) = x^3 - 3x - 5$ correct to 3dp by Newton-Raphson method upto 4 iterations (4 marks)
- iv. Find a quadratic Lagrange interpolation associated with the data values below; $(1, -3)$, $(3, 9)$, $(4, 30)$. Use it to find (5 marks)
- v. Tabulate the function $2x^3 - 3x + 1$ for $x = 0(1)6$ and construct a difference table up to the 2^{nd} difference (3 marks)
- Take $x_0 = 2$ use the table to evaluate
- a) Δf_1 (1 mark)
- b) $\nabla^2 f_2$ (1 mark)
- c) $\delta^2 f_2$ (1 mark)

vi. Evaluate the integral $\int_0^6 \frac{dx}{1+x^2}$ by:

a) Trapezoidal rule (3 marks)

b) Simpson $\frac{1}{3}$ (3 marks)

QUESTION TWO (20 MARKS)

a. Given $\sin 0.4 = 0.38942$ and $\sin 0.5 = 0.47943$ approximate the value of $\sin 0.45$ using linear Lagrange interpolating polynomial (4 marks)

b. Find the approximate value of $\sqrt[3]{18}$ using Newton-Raphson method $x_0 = 2.5$ (4 marks)

c. Find the approximate value of the equation $x^3 + x - 1$ lying between $x = 0.5$ and $x = 1$ by regular falsi method. Perform four iterations giving your answer to 4dp (12 marks)

QUESTION THREE (20 MARKS)

a. Define the following terms:

a) Truncation error (1 mark)

b) Round off error (1 mark)

b. Evaluate $\int_0^{2.4} e^{-\frac{x^2}{3}} dx$, correct to 4sf using mid-ordinate rule with 6 intervals (7 marks)

c. Find the approximate root of the equation $x^3 + x^2 - 3x - 3 = 0$ lying between 1 and 2 by bisection method up to 8 iterations and give 3 decimal place (11 marks)

QUESTION FOUR (20 MARKS)

i. Use the equation $f(x) = 3x^3 - 6x - 2$ to show that $x_n = \sqrt[3]{\frac{6x_n + 2}{3}}$, use $x_0 = 1$ get linear iterates to 5 dp (10 marks)

ii. The table below was generated from a cubic polynomial. One value of $f(x)$ is wrong. By drawing a difference table up to 3rd difference, detect the wrong value and correct it

X	0.1	0.3	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.9
F(x)	1.102	1.354	1.750	2.386	3.583	4.762	6.694	9.250	12.526	16.618

(10 marks)

QUESTION FIVE (20 MARKS)

i. Find the percentage error in the quotient $\frac{25.4}{12.37}$ (4 marks)

ii. A function is defined by the table

x	0.2	0.4	0.6	0.8
f(x)	0.576	1.168	1.872	2.784

Estimate f(0.54) and f(0.9) use linear interpolation to (6 marks)

iii. Construct the difference table for the following data tabulated function:

x	1.0	1.2	1.4	1.6	1.8	2.0
f(x)	1.5431	1.8107	2.1509	2.5775	3.1075	3.7622

Use suitable Newton's interpolating polynomial to estimate f(1.1) and f(1.9) (10 marks)