



NATIONAL OPEN UNIVERSITY OF NIGERIA
University Village, 91 Cadastral Zone, Nnamdi Azikwe Expressway, Jabi, Abuja
FACULTY OF SCIENCES
COMPUTER SCIENCE DEPARTMENT
2022_2 EXAMINATIONS

CIT 335: Computational Science & Numerical Methods

Credit: 3 units

TIME ALLOWED: 2½ Hours

INSTRUCTION: Answer Question 1 and any other THREE (3) Questions

Question 1

- a. What is an interpolation problem? (4 marks)
- b. Explain the two ways by which the number of the digit in a numerical value can be reduced. (4 marks)
- c. Round and chop the following numbers into 3 decimals. (4 marks)
 - i. 1.23767
 - ii. 0.774501
 - iii. 6.3225
 - iv. 6.3235
- d. Discuss the condition of a problem. (10 marks)
- e. Briefly describe the reason why a real number cannot in general be represented exactly in a computer? (3 marks)

Question 2

- a. Briefly describe the concept of a machine number. (5 marks)
- b. With the aid of a diagram describe the Packaging of a floating-point number in a machine register. (5 marks)
- c. Express the equation of the abbreviated form of the infinitely binary digits used to represent a real number. (3 marks)
- d. Define the term Inner product. (2 marks)

Question 3

- a. Explain number representation in computational science. (5 marks)
- b. The function $f(\alpha) = \sqrt{\alpha}$ for $\alpha = 2.05 \pm 0.01$. Estimate the propagated error using mean value theorem. (4 marks)
- c. Briefly discuss the normalization of binary fraction. (6 marks)

Question 4

- a. With the aid of diagram only, describe explicitly different sources of error. (5 marks)
- b. Discuss the computational effect of a real nonzero number whose modulus is not in the range of a normalized floating-point number that can be represented in a computer. (7 marks)

- c. The unit roundoff in a binary floating-point system is $\mu = 0.5 \cdot 2^{-t}$, how many digit must we have in a decimal system with approximately the same unit roundoff? **(3 marks)**

Question 5

- a. Discuss the model of machine arithmetic. **(4 marks)**
b. Write a short-note on the condition of a number. **(6 marks)**
c. Highlight the basic features that differentiate the fixed-Point data structured numbers from the floating-point numbers. (5marks)

Question 6

- a. Explain the term Symmetric rounding. (4 marks)
b. Using multiplication operation, briefly discuss the phenomenon of errors in a result caused by errors in the data. (5 marks)
c. Briefly analyze the concept of error propagation in computational science (4 marks)
d. What is a floating-point system (β, t, L, U) ? **(2 marks)**