

BOWEN UNIVERSITY, IWO
COLLEGE OF COMPUTING AND COMMUNICATION STUDIES
COMPUTER SCIENCE PROGRAMME
B.Sc. DEGREE SECOND SEMESTER EXAMINATION
2022/2023 SESSION **COURSE CODE: CIT 316**
COURSE TITLE: Computational Science and Numerical Computation
COURSE CREDIT: 3 **DATE: JUNE, 2023** **TIME: 2 HRS 30MINS**
INSTRUCTION: Attempt any two (2) Questions from each section

SECTION A

QUESTION ONE

(a). Given the equation $X^2 - 2X - 3 = 0$. Show that the iteration schemes:

(i) $X_{n+1} = (2X_n + 3)^{1/2}$ (3marks)

(ii) $X_{n+1} = 3/X_n - 2$ can be derived. Hence obtain a root of the equation using an initial approximation $X_0 = 4$. Give four iterations each. (3marks)

(b). Solve the equation $9X^3 - 11X^2 + 18X - 22 = 0$, given that it has one real root.

Hint :Use Newton Raphson method..... (7marks)

(c) State what you understand by Numerical Computation and briefly discuss 4 general types of Errors in Numerical Computation with examples. (8marks)

(d) How does research operations affect decision making in a company? (4marks)

QUESTION TWO

(a) Extensively discuss what you understand by Numerical Analysis and state the difference between Numerical Computation and Numerical Analysis. (5marks)

(b) Evaluate B-A and CD. Discuss the error in each approximation given that the numbers 3.724, 2.251, 4.701 and 0.832 are correctly rounded approximations to the numbers A, B, C, and D respectively; round off to 2 (8marks)

(b) The number 7.36 is a correctly rounded approximation to the number A. Using table of square roots, obtain as accurate approximation as possible to \sqrt{A} . (4marks)

(c) Derive the Newton's Iterative method for the equation of the form $F(x) = 0$ and Solve the Equation:

$X^3 + X - 1 = 0$ for $X \in \{0, 1\}$. (8marks)

QUESTION 3

(a) i. Derive and prove the Trapezoidal rule. (6marks)

ii. Also given the data below: (3marks)

| | | | | | | | | |
|------|--------|--------|--------|--|--------|--------|--------|--------|
| X | 2.0 | 2.5 | 3.0 | | 3.5 | 4.0 | 4.5 | 5.0 |
| F(x) | 1.7321 | 1.8788 | 2.0000 | | 2.1213 | 2.2761 | 2.3452 | 2.4495 |

Evaluate $\int_2^5 f(x)dx$ using Trapezoidal Rule formula

(b) Briefly discuss the three phases of Operations Research Approach. (6marks)

(c) Why the need for models? (4marks)

(d) Discuss the relevance of a Quantitative Techniques in a Business Management, also differentiate between Qualitative Analysis and Quantitative Analysis. (6marks)

SECTION B

QUESTION 4

- (a) Operation Research can be termed as a scientific approach to decision making that involves the operations for any organized systems. Discuss and state the advantages and limitations involved. (10marks)
- (b) State and Establish the following:
- (i) Backward differences table (3marks)
 - (ii) Central differences table. (4marks)
- (d) Construct the forward difference table for the function $f(x) = x^3$ with the values $x_0 = 1$ and $h=1$, $r=0(1)6$ where $r=0,1,2,\dots,6$ and state its importance. (8marks)

QUESTION 5

- (a) What is queue theory? (3marks)
- (b) Explain the basic structure of queue models (9marks)
- (c) In a particular local government office, farmers patiently form a single line to hire a tractor into their farm. Farmers are attended to based on first come first serve. priority rule. On the average 16 farmers per hour arrived at the local government office. Farmers arrival are best described using a poisson distribution. The tractor can help an average of 20 farmers per hour with the service rate being described by an exponential distribution. Obtain the following :
- i. The average utilization of the tractor service (1mark)
 - ii. The average number of farmers in the system (2marks)
 - iii. The average number of farmers waiting in line (2marks)
 - iv. The average time a farmer spend in the system (2marks)
 - v. The average time a farmers spends waiting in line (2marks)
 - vi. The probably of having more than five farmers in the system. (4marks)

QUESTION 6

- (a) Briefly explain each of the following as it is applicable to queue theory:
- (i) Balking (2marks)
 - (ii) Reneging (2marks)
- In a banking system, instead of a single person working at the help desk, the bank is considering a plan to have three identical service providers. It expects that customers will arrive at a rate of 45 per hour, according to a poisson distribution. The service rate for each of the three services is 18 customers per hour with exponential service time. Calculate:
- (b) The average utilization of the help desk (3marks)
- (c) The probability that there are no customer in the system (5marks)
- (d) A television repair man finds that the time spend on his job has an exponential distribution with mean 30 minutes. if he repairs a set in the order in which they arrive, and if the arrival of sets are approximately poisson with an average rate of 10 per 8 hours per day. Find

- (i) Server utilization factor (2marks)
- (ii) Expected no of televisions in the system (2marks)
- (iii) Expected number of television in queue (2marks)
- (iv) Probability of the repair man being idle (2marks)
- (v) Average time the repair man will be idle (3marks)
- (vi) Explain the concept of (M/M/1) in queue theory (2marks)