MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

UNIVERSITY POSTGRADUATE EXAMINATION

2023/2024 ACADEMIC YEAR

FIRST YEAR **FIRST** SEMESTER EXAMINATION FOR MASTER OF SCIENCE IN INFORMATION TECHNOLOGY

SIT – 600 PROBLEM SOLVING WITH PROGRAMMING

DURATION: 3 HOURS

Instructions to candidates:

1. Answer Any Four questions.

2. Mobile phones are not allowed in the examination room.

3. You are not allowed to write on this examination question paper.

QUESTION ONE (25 MARKS)

(a) Use the steps of problem solving to draw an analogy with those of solving programming problems accompanied by some explanation. (5 marks)

(b) Give detailed explanation of a how a compiler works (5 marks)

(c) Compare and contrast procedural and object oriented programming paradigms. (10 marks)

(d) Describe how the concept of modularity is implemented in structured programming languages. (5 marks)

QUESTION TWO (25 MARKS)

a) Compare and contrast the following program control structures as implement in C and Java programming languages.
   i.   Sequential structure (5 marks)
   ii. Selection structures (5 marks)
   iii. Election structures (5 marks)
   iv. Recursion (5 marks)

b) Write a program in either Java OR C programming language to illustrate the concept of recursion (5 marks)

QUESTION THREE (25 MARKS)

(a) Compare and array and linked list implementation of basic data structures such as stacks and queues. (12 marks)

(b) A program is required to store records of students taking a programming unit. Each student record consists of the name, student number, age and gender of the student.

   Required.

   Write and explain a program in either C or Java that will solve the problem above by use of appropriate data structure(s) (13 marks)

QUESTION FOUR (25 MARKS)

(a) Explain how the following two approaches of decomposition work:
   i.   Top–down design (4 marks)
   ii. Divide and conquer (4 marks)

(b) Read the programming problem below and use it to answer the questions that follow;
   Programing problem
   A Program is required to manage information in a public library. The data about the user of the library is collected and stored before they can be allowed to borrow books.

A user who borrows a book must first identify the book and the duration to borrow in terms of days. These details are recorded by the program for use when the book will be returned. Information about the returning the book is also recorded.

Required:

Decompose the problem into manageable programming modules by:

   i.   Designing the program structure required to solve this problem.   (3 marks)

   ii. Identify the functions required and what each function does.   (4 marks)

   iii. Identify the data requirement for each function above.   (4 marks)

   iv. Writing an algorithm for each of the functions above.   (6 marks)

NB: You are not required to write a computer program for this problem

QUESTION FIVE (25 MARKS)

a) Compare and contrast program testing and program debugging.   (5 marks)

b) Compare and contrast the following pairs of algorithms and give an example for each group.
     i.   Greedy algorithms and dynamic programming.   (5 marks)
     ii.   Divide and conquer algorithms and decrease and conquer algorithms.   (5 marks)

c) Describe the factors that a programmer would consider when choosing a programming language to use in solving programming problems.   (5 marks)

d) Explain how a linker works during the execution of a computer program.   (5 marks)