

**KABARAK**



**UNIVERSITY**

**UNIVERSITY EXAMINATIONS  
MAIN CAMPUS**

**FIRST SEMESTER 2018 ACADEMIC YEAR**

**EXAMINATION FOR THE DEGREE OF SCIENCE IN INFORMATION  
TECHNOLOGY**

**COMP 214 /COMP324**

**STREAM: Y2S1**

**TIME: 2:00-4:00PM**

**EXAMINATION SESSION: DEC**

**DATE 5/12/2018**

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- 1. This question paper has five questions**
  - 2. QUESTION ONE IS COMPULSORY AND HAS 30 MARKS**
  - 3. Answer any other two questions worth 20 marks each.**

**QUESTION ONE (30 marks)**

- (a) Determine with the use of stack operations whether the following nested parentheses is given in the correct pattern ( ( ( ) ( ) ) (4mks)
- (b) Explain Fibonacci series as an implementation of recursion. Explain its base and recursive cases and their importance. (4mks)
- (c) What is complexity analysis? Give two forms of complexity analysis with examples. (5mks)
- (d) Explain best, worst and average analysis of an algorithm (3mks)
- (e) The alphabets A to H are stored in a 2x3 matrix; Explain how to declare these alphabets in an array and show their respective positions of each element in the array. (5mks)
- (f) What is an array? Explain how to declare and assign values to a two-dimensional array in C language. (5mks)
- (g) What is a pointer? Explain indirection (2mks)

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*As members of Kabarak University family, we purpose at all times and in all places, to set apart in one's heart, Jesus as Lord. (1 Peter 3:15)*



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- (h) When does best case analysis occur in a linear search? (2mks)

### QUESTION TWO (20 marks)

- (a) Performing dequeue and enqueue operations on linear queue brings about challenge.  
Explain this challenge and how circular queue solves this problem (4mks)
- (b) Explain how you can use array in stack representation. (3mks)
- (c) Give any three applications of a graph. (3mks)
- (d) Explain the use of stack in matching of braces in an expression (5mks)
- (e) What is a tree? Explain with the aid of a diagram, root, ancestors, siblings, descendants and leaves in a tree (5mks)

### QUESTION THREE (20 marks)

- (a) Explain with the aid of diagrams circular linked list and doubly linked list (4mks)
- (b) What is a binary tree? Explain symmetric order in binary tree. (5mks)
- (c) What is the difference between full and complete binary tree (2mks)
- (d) What is the position of rear and front in an empty queue (2mks)
- (e) Draw any weighted and directed graph with five vertices and demonstrate how to represent it using adjacency matrix (5mks)
- (f) What is the difference between the height of a tree and the depth of a node? (2mk)

### QUESTION FOUR (20 marks)

- (a) The time complexity when determining the efficiency of algorithm is measured by using which parameters (2mks)
- (b) What is hashing? Explain how it is used to represent large digit numbers (2mks)
- (c) Explain the tower of Hanoi as an implementation of recursion (5mks)
- (d) Explain two ways of handling collision. (2mks)
- (e) Assume that you want to store integer elements named 'numbers' in list. Explain which structure to use and how to implement the storage of these elements in C (5mks)



- (f) How does underflow and overflow condition occur? Explain how to test these condition in C language. (4mks)

**QUESTION FIVE (20 marks)**

- a) Every Algorithm must satisfy the different properties. Explain five of those properties (5mks)
- b) What is recursion? Write the procedure of executing the minimal number for the tower of Hanoi having any number of disks (5mks)
- c) Show how a sequence of enqueueing and dequeuing represented by a linear array can cause overflow to occur upon an attempt to insert an element into an empty queue (5mks)
- d) Draw a perfect binary search tree with seven nodes and demonstrate how to search for one of the leaf nodes (5mks)



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**FIRST SEMESTER, 2017/2018 ACADEMIC YEAR**

**EXAMINATION FOR THE DEGREE OF BACHELOR SCIENCE IN COMPUTER  
SCIENCE**

**COMP 214/ COMP123: DATA STRUCTURE IN C**

**STREAM: Y2S1/Y1S2**

**TIME: 2.00-4.00 PM**

**EXAMINATION SESSION: DECEMBER**

**DATE: 11/12/2017**

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**INSTRUCTIONS:**

- 1. This question paper has five questions**
- 2. QUESTION ONE IS COMPULSORY AND HAS 30 MARKS**
- 3. Answer any other two questions worth 20 marks each.**

**QUESTION ONE (30 marks)**

- (a) Given the stack  $S$  and item  $i$  show how to use stack operations to push and pop an item to and from a stack respectively (2mks)
- (b) Performing dequeue and enqueue operations on linear queue brings about challenge. Explain the challenge and its solution (4mks)
- (c) Determine whether the following nested expression is given in a correct pattern by using matching of braces application;  $((A+B)*(C-D))E)$  (5mks)

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- (d) What is complexity analysis? Give two forms of complexity analysis with examples. (5mks)
- (e) How does underflow and overflow condition occur? Explain how to test these condition in C language. (4mks).
- (f) Explain best, worst and average analysis of an algorithm (3mks)
- (g) What is an array? Explain how to declare and initialize two-dimensional array in C language. (5mks)
- (h) Explain how you can use array in stack representation. (3mks)
- (i) What is a pointer? Explain indirection (2mks)

### **QUESTION TWO (20 marks)**

- (a) The progression of numbers from 1 to 8 are stored in a 4x2 matrix; Explain how to declare these numbers in an array and show their respective positions of each element in the array. (5mks)
- (b) Give any three applications of a graph. (3mks)
- (c) When does best case performance occur in a linear search? (2mks)
- (d) Explain the tower of Hanoi as an implementation of recursion (5mks)
- (e) What is a tree? Explain with the aid of a diagram, root, ancestors, siblings, descendants and leaves in a tree (5mks)

### **QUESTION THREE (20 marks)**

- (a) The time factor when determining the efficiency of algorithm is measured by using which parameters (2mks)
- (b) What is the advantage of circular doubly linked lists over other types of linked lists (4mks)
- (c) What is a binary tree? Explain depth first order in binary tree. (5mks)
- (d) What is the difference between full and complete binary tree (2mks)
- (e) What is the position of rear and front in an empty queue (2mks)

- (f) Explain the use of stack in manipulation of expression notations (5mks)

**QUESTION FOUR (20 marks)**

- (a) Draw any weighted and directed graph with five vertices and demonstrate how to represent it using adjacency matrix (5mks)
- (b) What is hashing? Explain how it is used to represent large digit numbers (2mks)
- (c) What is the difference between the height of a tree and the depth of a node?(2mk)
- (d) Explain two ways of handling collision. (2mks)
- (e) Explain Fibonacci series as an implementation of recursion. Explain its base and recursive cases and their importance. (4mks)
- (f) Assume that you want to store integer elements named Num in list. Explain which structure to use and how to implement the storage of these elements in C (5mks)

**QUESTION FIVE (20 marks)**

- a) Write a code in C programming language to define a stack structure and explain the contents of that code (3mks)
- b) If the index position of the rear and the front of the queue are 1 and 3 respectively, how many elements are there in that queue? (4mks)
- c) If  $h$  is the height of the tower representing the number of disks and A B and C representing the three rods, explain the steps of using the minimal moves in playing the Tower of Hanoi puzzle (6mks)
- d) Demonstrate how you delete a node with two child nodes in a binary search tree(BST) (4mks)
- e) What is a hash function? Name two desirable properties of a hash function. (3mks)

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**SECOND SEMESTER, 2016/2017 ACADEMIC YEAR**

**EXAMINATION FOR THE DEGREE OF BACHELOR SCIENCE IN COMPUTER  
SCIENCE**

**COMP 214/INTE 123/COMP123: DATA STRUCTURE**

**STREAM: Y2S1& Y1S2**

**TIME: 11.00-1.00PM**

**EXAMINATION SESSION: AUGUST**

**DATE: 27/7/2017**

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**INSTRUCTIONS:**

- 1. This question paper has five questions**
- 2. QUESTION ONE IS COMPULSORY AND HAS 30 MARKS**
- 3. Answer any other two questions worth 20 marks each.**

**QUESTION ONE (30 marks)**

- a) Write a code in C programming language to define a stack structure and explain the contents of that code (3mks)
- b) Show how to implement stack of integers in C using array with the size defined globally (3mks)
- c) Write a code in C to implement a queue using an array. Explain all the variables used in the implementation (3mks)
- d) Show how a sequence of enqueueing and dequeuing represented by a linear array can cause overflow to occur upon an attempt to insert an element into an empty queue (5mks)

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- e) What are the disadvantages of representing a stack or a queue by a linked lists (2mks)
- f) How do you choose a good hash function? (2mks)
- g) Explain any two application of a graph (2mks)
- h) Convert the following infix expressions to postfix and prefix  $A+B*(C*B-D)$ . (4mks)
- i) Explain using an example the best, worst and average case analysis of an algorithm (3mks)
- j) List any three application areas of queues (3mks)

#### QUESTION TWO (20 marks)

- a) If the index position of the rear and the front of the queue are 0 and -1 respectively, how many elements are there in that queue? (4mks)
- b) What is the value of the postfix expression  $6\ 3\ 2\ 4\ +\ -\ *$  (3mks)
- c) If  $h$  is the height of the tower representing the number of disks and A B and C representing the three rods, explain the steps of using the minimal moves in playing the Tower of Hanoi puzzle (6mks)
- d) Write a code in C to declare the following elements into one dimensional array and show their respective index positions; A, B, C, D, F (5mks)
- e) What is a pointer? Explain the use of pointer in linked list (2mks)

#### QUESTION THREE (20 marks)

- a) What is a hash function? Name two desirable properties of a hash function. (3mks)
- b) Explain the three cases of deletion in a binary search tree(BST) (6mks)
- c) Explain underflow and overflow in stack and how to test this conditions in C language (3mks)
- d) Using an example of a 3x4 matrix with integer values, show the respective index position of each element in the matrix (3mks)
- e) Write a code in C to define a linked list and explain the parts of this structure (4mks)

#### QUESTION FOUR (20 marks)

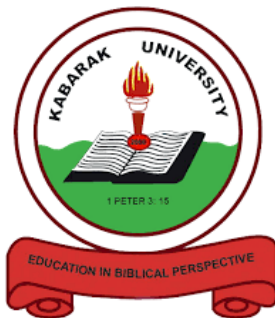
- a) Given a hash table of size 6, show the contents of your hash table after inserting the values {15, 13, 23, 16, 20, 16} using modulo 10 division with linear probing for collision resolution. (5mks)
- b) Write the code in C that will test the emptiness of a linear queue (4mks)
- c) What is a binary tree? Explain depth first order in binary tree (5mks)
- (a) Explain the difference between a tree and a graph? (2mks)
- d) What is recursion? Explain the factorial of a number as a recursive method showing the base case and the recursive case (4mks)



**QUESTION FIVE (20 marks)**

- a) Explain the use of stack operations to demonstrate whether the following sequence of parentheses are balanced,  $((() (()) (()) )$  (4mks)
- b) Demonstrate how to declare and assign values to a three dimensional array (5mks)
- c) Given a weighted, undirected graph with 5 nodes, how do you implement the storage of this graph (5mks)
- d) How do you handle a situation where a hash function produces the same result of the position of index in the list of elements? Explain (4mks)
- e) What is the index position of any top of stack if n is the number of elements (2mks)

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**SECOND SEMESTER, 2016/2017 ACADEMIC YEAR**

**EXAMINATION FOR THE DEGREE OF BACHELOR SCIENCE IN COMPUTER  
SCIENCE**

**COMP 214: DATA STRUCTURES**

**STREAM: Y2S1**

**TIME: 9.00-11.00 A.M**

**EXAMINATION SESSION: APRIL**

**DATE: 10/04/ 2017**

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**INSTRUCTIONS:**

- 1. This question paper has five questions**
- 2. QUESTION ONE IS COMPULSORY AND HAS 30 MARKS**
- 3. Answer any other two questions worth 20 marks each.**

**Question One: [30 MARKS]**

- What is the characteristic of computer memory that makes it simpler to organize data efficiently (2mks)
- Write a code in C to show the use of array in defining stack. Show how underflow and overflow are tested (4mks)
- How many leaf and non-leaf nodes are present in a perfect binary tree if its depth is 3? (3mks)
- Write a small code to define linked list as a structure in C programming language (3mks)

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- e. Explain base case and recursive case in both factorial of a number and Fibonacci series (4mks)
- f. Draw a perfect binary tree of two levels with labeled nodes and show all the three traversal methods (6mks)
- g. What is complexity analysis? Give two forms of complexity analysis with examples. (5mks)
- h. Explain using an example the best, worst and average case analysis of an algorithm (3mks)

**Question Two: [30 MARKS]**

- a. List any two application areas of queues (2mks)
- b. A company contains 100 employees each having a unique 5 digit number. Demonstrate how to represent these employees uniquely using two digit numbers (5mks)
- c. Consider the following nested parenthesis. Explain how to use the stack operations to prove if the expression is nested correctly.  
 $(((((())())())))$  (5mks)
- d. If the index position of rear=2 and that of front=0, how many elements are present in that queue (3mks)
- e. What is an array? Explain how to declare and initialize one-dimensional array in C language. (5mks)

**Question Three: [30 MARKS]**

- a. Write a C function that tests the recursive and the base case of a Fibonacci of a number  $n$  (2mks)
- b. Transform the following expression to prefix and postfix;  
 $(A+B)*(C-D)/E-F$  (4mks)
- c. Draw any directed graph of six nodes. Demonstrate how to represent it using adjacency matrix (4mks)
- d. Explain with the aid of a diagram circular linked list and doubly linked list (4mks)
- e. Explain the following terms:
  - 1. Collision
  - 2. Linear Probing
  - 3. Quadratic Probing (6mks)

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**Question Four: [30 MARKS]**

- a. Express the recursive solution of the Tower of Hanoi problem of moving  $n$  disks from rod A to C using B as an auxiliary (5mks)
- b. Why do we consider an array elements as 'similar' and 'finite' (2mks)
- c. What is the use of pointers? Demonstrate with the use of a diagram (3mks)
- d. Write an algorithm for finding duplicate of a value in a binary search tree (6mks)
- e. What is the advantage of circular doubly linked list over other types of linked lists (2mks)
- f. What is the difference between a tree and a graph. (2mks)

**Question Five: [30 MARKS]**

- a. Explain the three dimensional array using a two dimensional array (4mks)
- b. Write a code in C programming language to define a stack structure and explain the contents of that code (3mks)
- c. If  $h$  is the height of the tower representing the number of disks and A B and C representing the three rods, explain the steps of using the minimal moves in playing the Tower of Hanoi puzzle (6mks)
- d. Demonstrate how you delete a node with two child nodes in a binary search tree(BST) (4mks)
- e. What is a hash function? Name two desirable properties of a hash function. (3mks)