



**ELIZADE UNIVERSITY,  
ILARA-MOKIN,  
ONDO STATE**

**FACULTY: BASIC AND APPLIED SCIENCES  
DEPARTMENT: MATHEMATICS AND COMPUTER SCIENCE  
2<sup>nd</sup> SEMESTER EXAMINATIONS  
2016 / 2017 ACADEMIC SESSION**

**COURSE CODE: CSC 428**

**COURSE TITLE: Algorithms and Complexity Analysis**

**DURATION: 2 Hours**

**COURSE LEADER: Mr. O. Babalola**

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**HOD's SIGNATURE**

**INSTRUCTION:**

You should answer any **THREE** Questions. There are **60** marks in total for the examination paper.

Students are warned that possession of any unauthorized material in an examination is a serious offence.

1. Using a simple list and with asymptotic notation, describe the (a) best case, (b) average case, and (c) worst case of

a. sequential search b. binary search **10 marks**

2. You have to sort 1 million random items. How will you approach this problem? In other words, write the most efficient fundamental CS algorithm for sorting and explain why that choice is the best in this instance. **10 marks**

3. Factorials can be generated using recursive and non-recursive approaches.

Write a recursive algorithm to generate factorials

Derive a recurrence relation for the algorithm

Solve the relation and thence state the complexity of the algorithm **10 marks**

4. i. What is the Divide and Conquer strategy? Mention three popular computer science algorithms that are based on this technique?

What is Big- $\theta$ ? What is Big-O? What is Big- $\Omega$ ? **10 marks**

ii. Examine  $n$  and complete the table (assuming a linear search algorithm) **4 marks**

|       | best case | average case | worst case |
|-------|-----------|--------------|------------|
|       |           |              |            |
|       |           |              |            |
| 0     |           |              |            |
| 00    |           |              |            |
| 000   |           |              |            |
| 0,000 |           |              |            |

5. You are playing guess a number with your friend. You have to guess a number between 1 and 1,000,000. Your friend can only tell you if your guess is  $<$ ,  $>$ , or  $=$  to the number. How can you ensure you guess the number in 20 or less tries? **4 marks**

6. i. What do you understand by asymptotic analysis? Why is it important?

How do you measure the time complexity of an algorithm?

Two algorithms have the same measured running time for the same input size, do they have the same complexity? Explain your answer.

What is the difference between classes  $O(n)$ ,  $O(n^2)$ , and  $O(n^3)$ ? **12 marks**

ii. With a labelled example, explain the similarities between a tree and a graph.

Draw a binary tree for a hypothetical family, your tree should cover at least three generations. Label each node with the name and age of the family member represented by the node.

List 'popular' 10 algorithms you know and give a brief explanation of 5 algorithms. Additional points will be given for stressing their performance under large inputs. **20 marks**

7. i. Why are hash tables interesting?

What is the difference between a hash table and an array?

Use an example to illustrate collision in a hash table

How is collision managed in hash tables?

Explain the various operations on a hash table (in terms of best case and worst case times). Some operations such as insertion, accessing, with or without collision-situations are some of the operations you may want to discuss. **20 marks**