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University Examinations 2024/2025

THIRD YEAR FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

CCS 3300: DESIGN AND ANALYSIS OF ALGORITHMS

DATE: JANUARY 2025 **TIME: 2 HOURS**

INSTRUCTIONS: *Answer question **ONE** (Compulsory) and any other **TWO** questions*

QUESTION ONE (30 MARKS)

a) Explain the following terms as used in algorithms design

i. Algorithm (2 marks)

ii. An instance of a problem (2 marks)

iii. Loop invariant (2 marks)

b) Outline FIVE characteristics of a good algorithm. (5 marks)

c) Using a suitable example, describe the steps of algorithm design and analysis process. (6 marks)

d) Explain the concept of asymptotic notations indicating the commonly used notations and their significance. (6 marks)

e) Explain what is an optimization problem (2 marks)

f) Using an example, explain TWO parameters that could be used to measure the efficiency of a program code. (5 marks)

QUESTION TWO (20 MARKS)

a) Define recursion in algorithms analysis and design (1 mark)

b) State three loop invariance property that prove the algorithm is correct. (3 marks)

c) Explain THREE differences between an algorithm and program code (6 marks)

d) Outline the steps undertaken with the following algorithms, in order to achieve their goals.

i) Breadth first search algorithm (5 marks)

ii) Divide and concur algorithm (5marks)

QUESTION THREE (20 MARKS)

a) Describe any TWO practical applications of problem solved by algorithms (4 marks)

b) Differentiate between Deterministic and Non-Deterministic algorithms. (3 marks)

c) Describe the procedure of divide and conquer approach to solve a programming problem. (6 marks)

d) Explain the following algorithm design operational techniques.

i) Dynamic programming (3 marks)

ii) Back tracking (2 marks)

e) Explain what is a computational problem? (2 marks)

QUESTION FOUR (20 MARKS)

a) Outline FOUR factors that influence the running time of an algorithm. (6 marks)

b) Compute the big –Oh and the small oh running time of the following code segment. (6 marks)

```
for (i = i; i<n; i++)
 {
   for (j = 1; j<n; j++)
   {
        Sum +=I;
    } }
```

c) With reference to quick sort algorithm code perform the following: -

i) Write a quick search algorithm (4 marks)

ii) Analyze the algorithm in terms of time and space complexity of the algorithm. (4 marks)

QUESTION FIVE (20 MARKS)

a) Using merge sort algorithm trace the sorting operation for the following sequence. 6, 2, 4, 6, 1, 3, 2, 6, and state its complexity. (8 marks)

b) Briefly explain how big oh notation models asymptotic growth rate happens. (4 marks)

c) Discuss the greedy algorithm method. (4 marks)

d) Explain what a Brute force method is, and name two of its applicability? (4 marks)