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**University Examinations 2014/2015**

THIRD YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE INFORMATION TECHNOLOGY AND BACHELOR OF SCIENCE COMPUTER SCIENCE

**CCS 3326: DESIGN AND ANALYSIS OF ALGORITHMS**

**DATE: APRIL 2015 TIME: 2 HOURS**

**INSTRUCTIONS:** *Answer question* ***one*** *and any other* ***two*** *questions*

**QUESTION ONE (30 MARKS)**

1. Define the term algorithm and briefly discuss any three real world application areas of algorithms (4 Marks)
2. Algorithm analysis is the study of an algorithm’s efficiency with respect to resource utilization, discuss these resources (4 Marks)
3. Define a heap data structure and give two conditions that must be met when developing a heap (3 Marks)
4. Citing example scenarios, explain the following types of analysis
5. Best case (2 Marks)
6. Worst case (2 Marks)
7. Average case (2 Marks)
8. State any four function growth rates and for each discuss the impact on the running time when the input size (n) increases (8 Marks)
9. Write an algorithm that accepts a user input number then computes the sum of the digits

(3 Marks)

1. Determine the running time of the algorithm in part (f) above (2 Marks)

**QUESTION TWO (20 MARKS)**

1. Write the Bubble sort algorithm (Ascending order), determine the running time (big O) and illustrate how it will sort the following list of elements: 89, 45, 68,90,29,34 and 17.

(12 Marks)

1. Discuss any four advantages of using standard algorithms while developing a system

(8 Marks)

**QUESTION THREE (16 MARKS)**

1. Describe the asymptotic notation and discuss one advantage of using asymptotic notations to analyze algorithms (5 Marks)
2. Discuss how a Divide-and-Conquer algorithm works and state the nature of problems that can be solved using this approach (6 Marks)
3. Write the recursive binary search algorithm (6 Marks)
4. Determine the running time of the binary search algorithm in part (c) above (3 Marks)

**QUESTION FOUR (20 MARKS)**

1. Discuss the Greedy approach to problem solving and briefly discuss the components of a greedy algorithm (7 Marks)
2. Discuss the activity selection problem (3 Marks)
3. Write the greedy solution to the activity selection problem (4 Marks)
4. Describe the incremental paradigm, state a problem that can be solved using this paradigm and write the algorithm for the problem chosen (6 Marks)

**QUESTION FIVE (20 MARKS)**

1. Describe Dynamic Programming approach of solving problems and state any two example algorithms that apply this approach (5 Marks)
2. Describe the backtrack problem solving approach (3 Marks)
3. Apply Backtracking algorithm to solve the 8-puzzle by arranging the number sequentially. Clearly show each step (12 Marks)

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| 2 | 8 | 3 |
| 1 | 6 | 4 |
| 7 |  | 5 |