

Department of Electrical and Computer Engineering North South University

Final Term Examination

CSE 373: Design and Analysis of Algorithms

Section: 2

Fall 2020

Total Marks: 40

Total Time : 1hour 10 minutes + 10 minutes to upload

Instructions

1. Answer ALL questions
2. You should turn on the camera during the examination time
3. Answers need to be handwritten
4. The answer script needs to be uploaded via google classroom
5. You should compile your answers to a single pdf file. The name of the pdf file should be “your name”

1 Briefly explain the differences between the following classes of problems: P , NP , NP -hard and NP -complete 5 marks

2 In a rod cutting problem, given a table of prices p_i , the objective is to determine the maximum revenue r_n obtainable by cutting up the given rod (of length n) and selling the pieces. The rod cutting problem exhibits *optimal substructure property*. The following table shows the price table for one particular situation:

Length/ i	1	2	3	4	5	6	7	8
Price/ p_i	1	5	8	9	10	17	17	20

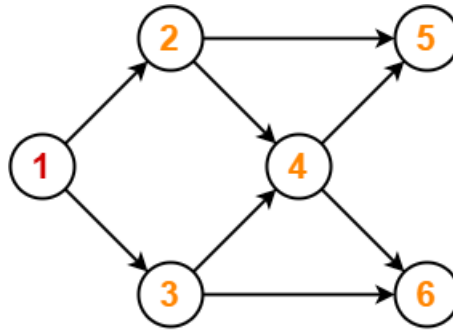
a) Suppose you have been asked to find r_4 . Use **greedy algorithm** to determine r_4 . Explain whether the greedy approach were able to find the optimal solution. 5 marks

You do not need to write any algorithm.

b) Explain whether you can solve the problem using **brute force** approach. State any practical problem you may have (if any) when solving the problem using brute force. 5 marks

- c) Write down the recurrence relation for solving the rod cutting problem and hence or otherwise explain how can you solve it using dynamic programming. **You do not need to write any algorithm.** 5 marks

- 2 a) The following diagram shows a DAG that represents a number of events $e = \{1, 2, 3, 4, 5, 6\}$ that needs to be carried out. 5 marks



The diagram shows the dependencies of events. For example, you need to complete event 1 before you start event 2 or 3. Suppose, the objective is to find a linear ordering of the vertices such that if (u, v) is an edge, then u precedes v in the ordering.

Explain how would you determine this linear ordering and state the time complexity of the algorithm.

- b) Dijkstra's algorithm can be used to solve the Single Source Shortest Path (SSSP) problem. Explain how this algorithm works. State clearly what do you do in the initialization phase and how it achieves its objective. **You do not need to write any algorithm.** 5 marks
- c) Dijkstra's algorithm uses a priority queue data structure. **Explain** what would be the time complexity of the Dijkstra's algorithm if the priority queue is built using
- i) array
 - ii) min-heap
- d) Explain how can you detect if a directed weighted graph contains a negative weighted cycle. State the time complexity that would be required to do so. 5 marks