Department of Electrical and Computer Engineering
North South University
Midterm Examination
Fall 2020
CSE 373
Section 9

Time: 1 hour 10 minutes + 10 minutes (to upload   Total Marks 35
the answer script)

Instructions
   1. Answer ALL questions
   2. You should turn on the camera during the examination time.
   3. Answers need to be handwritten
   4. Each page should contain the name and id of the student
   5. The answer script needs to be uploaded via google classroom
   6. You should compile your answers to a single pdf file. The name of the pdf file should be "your name"

1 Solve the following recurrence using recursion tree method   10 marks

   $T(n) = 2T(n\text{-}1) + c$, $n > 1$
   with the base case
   $T(n) = c$, $n = 1$

2 Read the following problem carefully.   10 marks

   You have N magical bags of candies in front of you. The ith bag has A_i candies in it. It takes you one minute to finish a bag of candies, no matter how many candies are there in it. Every time you finish a bag with X candies in it, the bag is magically replenished with X/2 (rounded down to the nearest integer) more candies.

   The input is a sequence of integers. The first integer N is the number of bags. The next integer K is the number of minutes you have. The next N integers is the number of candies in the bags. The output of your algorithm is a single integer which represents the maximum number of candies you can eat.

   For the input sequence, 5, 3, 2, 1, 7, 4, 2 , the output should be 14

   Write an algorithm that determines the maximum number of candies you can eat in K minutes. Explain carefully the data structure to be used and the worst case time complexity of your solution

3 You are in charge of a theater hall. You have received a number of requests for   10 marks
   different activities to take place (which requires the use of the theater hall) to mark

the birth of Sir Alan Turing. Many of these activities overlap and therefore cannot be simultaneously entertained. Your job is to come up with maximum number of activities that can be accommodated. The following table shows the start time and the finish time of different activities. Find which activities should you select? Two activities, i and j, are compatible if $s_i \geq f_j$ or $s_j \geq f_i$. You should clearly show your workings

Activity/ i	1	2	3	4	5	6	7	8
Start time / s_i	7	11	3	8	14	15	10	16
Finish time / f_i	13	14	5	11	16	17	13	19

4 Explain how does the partition algorithm in a randomized quicksort algorithm differ from that of the naive quicksort algorithm. You do not need to write any pseudocode.

5 marks