University of Dhaka

Dept. of Computer Science and Engineering

3rd Year 2nd Semester Incourse Examination 2020

Course Code: CSE 3203   Course Title: Design and Analysis of Algorithms-II

Time: One Hour   Full Marks: 30

1.	Calculate the prefix function showing all the steps of the KMP algorithm for the pattern "abbababba".	[Marks:10]
2.	Consider inserting the keys 59, 88, 17, 28, 15, 4, 31, 22, 10 sequentially into a hash table of length m=11. Hashtable follows double hashing with $h1(k) = (k+\lfloor m/2 \rfloor)\bmod$ <your roll no> and $h2(k) = 1 + (k \bmod (m-1))$ You have to simulate the insertion procedure step by step.	[Marks:10]
3.	Consider the following function "orientation" which takes three ordered 2-D points as an argument and returns 0 /1/2 if triplets are co-linear or make a clockwise or counter-clockwise turn. int orientation(Point p, Point q, Point r) { int val = (q.y - p.y) * (r.x - q.x) - (q.x - p.x) * (r.y - q.y); if (val == 0) return 0; // colinear return (val > 0)? 1: 2; // clock or counterclock } You are given a set of 2-D points: S, your task is to simulate (all steps) Graham-Scan algorithm to find convex-hull from set S as given below. You can utilize the "orientation" function for this purpose. S ={(0, 3), (-3, 1), (2, 2), (4, 5), (0, -2), (1, 2), (3, 1), (3, 3)} <You don't need to show sorting of the points according to polar angles>	[Marks:10]

1. Using False Position method to find solutions accurate to within   4
10^{-4} for the equation $f(x) = log(x - 1) + cos(x - 1)$ for $1.3 \leq x \leq 2$

2. Use the Bisection method to find solutions, accurate to within 10^{-4} 4
for the equation $f(x) = 3x - e^x$ for $1 \leq x \leq 2$

3. Consider the following matrix. Find the permutation matrix P so   4
that PA can be factored into the product LU, where L is lower
triangular with 1s on its diagonal and U is upper triangular for this
matrix.

$$A = \begin{vmatrix} 0 & 0 & -1 & 1 \\ 1 & 1 & -1 & 2 \\ -1 & -1 & 2 & 0 \\ 1 & 2 & 0 & 2 \end{vmatrix}$$

4. Use the Gaussian Elimination method to make a triangular matrix   4
for solving the following linear systems, (if possible, and determine
whether row interchanges are necessary): Finally determine the
value of $x_1 ... x_4$.

$$x_1 - \tfrac{1}{2} x_2 + x_3 = 4,$$

$$2x_1 - x_2 - x_3 + x_4 = 5,$$

$$x_1 + x_2 + \tfrac{1}{2} x_3 = 2,$$

$$x_1 - \tfrac{1}{2} x_2 + x_3 + x_4 = 5.$$

5. Let $S(x)$ a natural cubic spine is approximating a curve $f(x) = e^{-x}$ 4
using data points $(0, 1)$, $(1, e^{-1})$, $(2, e^{-2})$ and $(3, e^{-3})$. Make one of the
piecewise equations applicable for $x \in [1, 2]$.

University of Dhaka
Department of Computer Science and Engineering
3rd Year 2nd Semester In-course Examination, 2021
CSE – 3205, Introduction to Probability and Statistics

Total Marks: 25   Time: 1 Hour and 15 minutes

1. The test scores on a 100-point test were recorded for 20 students: 2

61	90	91	86	55	63	85	82	76	57
20	85	67	62	71	87	68	65	75	120

   Draw the box plot for the measurements and find out the outliers, if any.

2. Compute the correlation coefficient (r) and the equation of the regression line for the   7
   given data. Interpret the value of r in defining the direction and strength of the linear
   relationship between x and y.

x	1	3	5	7	9	11
y	9	8	11	14	15	17

3. On the first day of kindergarten, the teacher randomly selects 1 of his 30 students and   6
   records the student's gender, as well as whether or not that student had gone to preschool.
   a. Construct a tree diagram for this experiment. How many simple events are
   there?
   b. The table below shows the distribution of the 25 students according to gender
   and preschool experience. Use the table to assign probabilities to the simple events
   in part a.
   c. What is the probability that the randomly selected student is female? What is the
   probability that the student is a male and did not go to preschool?

	Male	Female
Preschool	11	6
No preschool	8	5

                                                                                        5
4. A company manufactures TVs at two different plants A and B. Plant A produces 80%,
   and B produces 20% of the total production. 85 out of 100 TVs produced at plant A meet
   the quality standards, while 65 out of 100 TVs produced at company B meet the quality
   standard. A TV produced by the company is selected at random and is not found to meet
   the quality standard. Find the probability that the selected TV was manufactured by plant
   B.

5. A college student frequents one of two coffee houses on campus, choosing Starbucks 65%   5
   of the time and Costa 35% of the time. Regardless of where she goes, she buys cafe
   mocha on 80% of her visits.
   a. The next time she goes into a coffee house on campus, what is the probability that she
   goes to Starbucks and orders a cafe mocha?
   b. Are the two events independent? Explain.
   c. What is the probability that she goes to Starbucks or orders a cafe mocha or both?

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3rd Year 2nd Semester Incourse Examination (Mock) 2020

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Time: One Hour   Full Marks: 30

1.	You have been given an ordered set of five 2-D point coordinates {(1, 2), (3, 4), (0, 10), (-5, 10) (-10, 0)}. Your task is to detect whether these points form a convex polygon or not in the backtracking approach. You have to draw the state space tree. Note: You cannot change the order of the points. The first and last points are also considered as adjacent.	[Marks:10]
2.	Suppose $\mathcal{H}$ forms a universal collection of hash functions. Calculate the expected insertion time of an arbitrary item with key k in the hash table with hash function randomly chosen from $\mathcal{H}$. Note that collision is resolved by chaining, and a new item is inserted at the end of the chain.	[Marks:10]
3.	Find all occurrences of "4347" from the following text: "4344743474743743474357" You have to use the "Rabin-Karp" algorithm keeping in mind your computer's word size is 10 bit, and the text is drawn from the set {2,3,4,5,6,7}	[Marks:10]