

**HARCOURT BUTLER TECHNICAL UNIVERSITY**  
**NAWABGANJ, KANPUR**  
Mid-Semester Examination, 3<sup>rd</sup> year BTech  
Odd Semester, 2022-23  
**ECS-355: DESIGN & ANALYSIS OF ALGORITHMS**

**Time: 1 hour**

**MM: 15**

**Note: Attempt all questions. All questions carry equal marks.**

1. Solve the function by using substitution method-

$$T(n) = \begin{cases} 1, & n = 1 \\ 8T\left(\frac{n}{2}\right) + n^2, & n > 1 \end{cases} \quad (3)$$

2. Explain Amortized Analysis with the help of a suitable example. (3)
3. Construct a B-Tree of order 3 by inserting numbers from 1 to 10 (write the steps only). (3)
4. Write a short note on Divide & Conquer approach. (3)
5. Explain Heap sort with the help of a suitable example. (3)

**III B. Tech. (CSE & IT), V Semester, 2022-2023**  
**Computer Networks, ECS-351**  
**I Class Test**

Time: 1 Hr.

Max. Marks: 15

Note: Attempt all questions.

**Q. 1** Explain ALOHA and Pure ALOHA in detail. Why is the channel throughput doubled in slotted ALOHA compared to pure ALOHA? (3)

**Q. 2** State the working of one – bit sliding window protocol in the data link layer. (3)

**Q. 3** Differentiate the following pairs – (3)

- Encoding and Modulation
- Multiplexing and Bandwidth

**Q. 4** Explain hidden node and exposed terminal problems in wireless local area networks. How are they countered? (3)

**Q. 5** A network with bandwidth of 10 Mbps can pass only an average of 12,000 frames per minute with each frame carrying an average of 10,000 bits. What is the throughput of this network? (3)

**Harcourt Butler Technical University, Kanpur**  
**MID SEM EXAM : 2022-2023**

**Class (Yr & Br) : 3-IT/CS**

**Semester : V**

**Subject: Database management system**

**Subject Code: ECS-353**

**Time: 1 hr**

**MM: 15**

- 1 Write down the difference between file system and DBMS.
- 2 Define three-schema architecture.
- 3 Write short notes on the following with an example:
  - a) Primary key
  - b) Candidate key
  - c) Super key
4. Draw E-R diagram for Library management system.
5. Write the SQL query for the following:
  - a) Select the detail of the employee from employee table whose name start with P.
  - b) Select the details of the employee whose email id is in gmail.
  - c) Select the details of the employee who work either for department E-14 or E-102.

✦ Good Luck ✦



**Mid Sem (Odd Semester) Examination 2022-23**

**OPERATIONS RESEARCH (BMA- 351)**

**III B.Tech. (CS/IT/ET/ME/CE/EE)**

Time: 1.00 hr.

MM: 15

**Note: Attempt any four questions:**

1. Let us assume that you have inherited Rs. 1,00,000 from your father-in-law that can be invested in a combination of only two stock portfolios, with the maximum investment allowed in either portfolio set at Rs. 75,000. The first portfolio has an average rate of return of 10%, whereas the second has 20%. In terms of risk factors associated with these portfolios, the first has a risk rating of 4 (on a scale from 0 to 10) and the second has 9. Since you wish to maximize your return, you will not accept an average rate of return below 12% or a risk factor above 6. How much should you invest in each portfolio?

Formulate this as a Linear Programming Problem and solve it by Graphical Method [4]

2. Solve the following Linear Programming Problem, [4]

$$\text{Max } z = 2x_1 + x_2$$

$$\text{Subject to: } 4x_1 + 3x_2 \leq 12$$

$$4x_1 + x_2 \leq 8$$

$$4x_1 - x_2 \leq 8$$

$$\text{and } x_1, x_2 \geq 0$$

3. Use Dual Simplex method to solve the following LPP: [4]

$$\text{Min } Z = x_1 + x_2 + x_3$$

$$\text{Subject to: } x_1 + 3x_2 + 4x_3 = 5$$

$$x_1 - 2x_2 \leq 3$$

$$2x_2 - x_3 \geq 4$$

$$\text{and } x_1, x_2 \geq 0, x_3 \text{ is unrestricted}$$

4. Solve by the following LPP by Revised Simplex method: [4]

$$\text{Min } Z = x_1 + 2x_2$$

$$\text{Subject to: } 2x_1 + 5x_2 \geq 6$$

$$x_1 + x_2 \geq 2$$

$$\text{and } x_1, x_2 \geq 0$$

5. Obtain an initial basic feasible solution of the transportation problem: [3]

|        | D   | E   | F   | G   | Available |
|--------|-----|-----|-----|-----|-----------|
| A      | 11  | 13  | 17  | 14  | 250       |
| B      | 16  | 18  | 14  | 10  | 300       |
| C      | 21  | 24  | 13  | 10  | 400       |
| Demand | 200 | 225 | 275 | 250 |           |





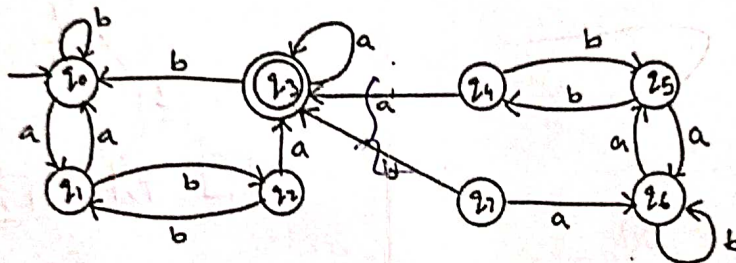
Harcourt Butler Technical University, Kanpur  
First Mid-Semester Examination 2022-2023  
Branch Third Year CS&IT  
Theory of Automata and Formal Languages (ECS-357)

MM: 15

Time: 1 Hour

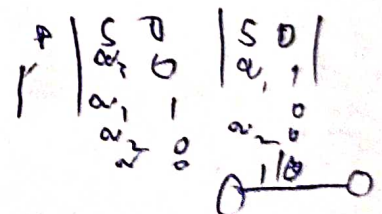
Note: All questions are compulsory

- Q1. Construct a DFA,  $w \in \{a, b\}^*$ ,  $n_a(w) \bmod 3 = 0$  and  $n_b(w) \bmod 3 = 0$ . (2.5)
- Q2. Construct a DFA which accepts set of all strings over  $\{0,1\}$ , which when interpreted as binary number is divisible by 2. (2.5)
- Q3. Find the minimize finite automata of the following figure. (2.5)



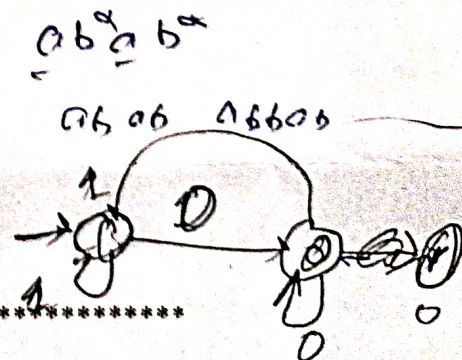
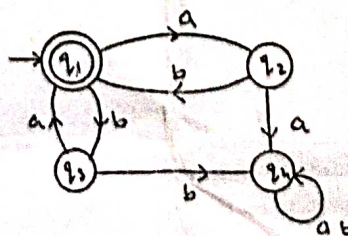
- Q4. Convert the following MOORE machine to the corresponding MEALY machine. (2.5)

| Present State | Next State |     | O/P |
|---------------|------------|-----|-----|
|               | q=0        | q=1 |     |
| → q0          | q3         | q1  | 0   |
| q1            | q1         | q2  | 1   |
| q2            | q2         | q3  | 0   |
| q3            | q3         | q0  | 0   |



- Q5. Regular expression for set of all strings in which no 2 a's should come together. (2.5)

- Q6. Write the Regular expression for the given figure. (2.5)



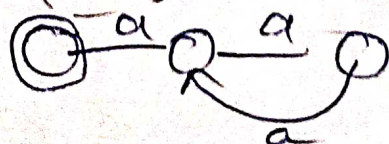
$$\mathcal{L}((ab)^* + b^*)$$

b ab

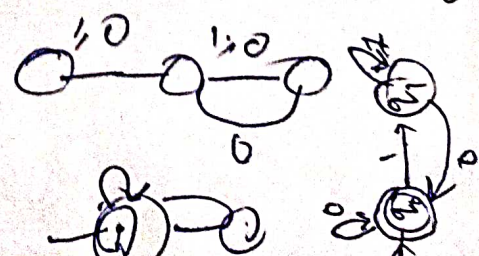
$$\mathcal{L} + (ab)^* + (ba)^* +$$

$$(abba)^* + (baab)^*$$

aa



$$(bab)^* (ab)^*$$



Good Luck



Date of showing evaluated answer books:

No. of Printed Pages: 2

Roll No. ....

**HARCOURT BUTLER TECHNICAL UNIVERSITY, KANPUR**

**B.Tech(CS/IT)**

**Mid Semester Examination**

**Odd Semester (I), 2022-23**

**ECS-359: DATA SCIENCE**

**Time: 1:00 Hours**

**Max. Marks: 15**

Note: 1. Attempt all questions. All questions carry marks, as shown against them.

Please mention all the Course Outcomes (CO) in statement form

1. This course create develop relevant programming abilities in the student.
2. This course create demonstrate proficiency with statistical analysis of data.
3. This course develops the ability to build and assess data-based models.
4. This course executes statistical analyses with professional statistical software.
5. This course demonstrates skill in data management.
6. Students will apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

|  | Related Course Outcome (CO) | Marks |
|--|-----------------------------|-------|
| Q. No. 1: What are the basic steps of solving real-world problems using Data Science?  | CO6                         | (03)  |
| Q. No.2: Attempt both questions.   |                             |       |
| (a) Differentiate between Regression and Classification.   | CO3                         | (02)  |
| (b) What are the four levels of Measurement? Give examples for each.   | CO5                         | (02)  |
| Q. No. 3: Attempt both questions.  |                             |       |
| (a) Calculate the Pearson first skewness coefficient for the set of numbers:<br>2, 5, 7, 7, 11, 12, 14, 15, 17, 20,22,40,44,44   | CO2                         | (02)  |
| (b) Draw the box plot for the following data:<br>4.3, 5.1, 3.9, 4.5, 4.4, 4.9, 5.0, 4.7, 4.1, 4.6, 4.4, 4.3, 4.8, 4.4, 4.2, 4.5, 4.4   | CO5                         | (02)  |
| Q. No. 4: Attempt both questions.  |                             |       |
| (a) One year, many college-bound high school seniors in the U.S. took the Scholastic Aptitude Test (SAT). For the verbal portion of this test, the mean was 425 and the standard deviation was 110.<br>Based on this information what percentage of students would be expected to score between 450 and 550? | CO2                         | (04)  |