



**NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI**  
**B.Tech. End Semester Exam - January 2022 SESSION**

Department : Computer Science and Engineering  
 Date : 22/04/2022  
 Sub Code & Title : CSPC41 Formal Languages and Automata  
 Faculty Name : R. LEELA VELUSAMY

Time: 10:00 am  
 Duration: 2 Hour  
 Max. Marks 60

Answer all the questions.  
 A detailed answer is expected

1. a) Design a DFA, M which accepts the language  $L(M) = \{w \mid w \in \{a, b\}^* \text{ and } w \text{ contain three or two consecutive b's}\}$ . (4)
- b) Describe in words the language accepted by the finite automaton given in Figure 1. In addition, trace a valid and invalid string of length  $\geq 6$  (3)

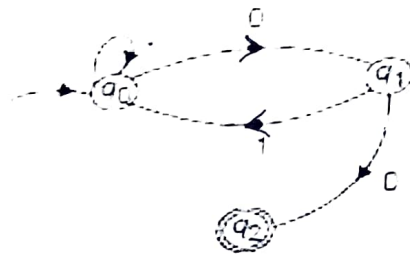


Figure 1

- c) Minimize the number of states for the DFA given in Figure 2 using the algorithm for marking pairs of inequivalent states. (5)

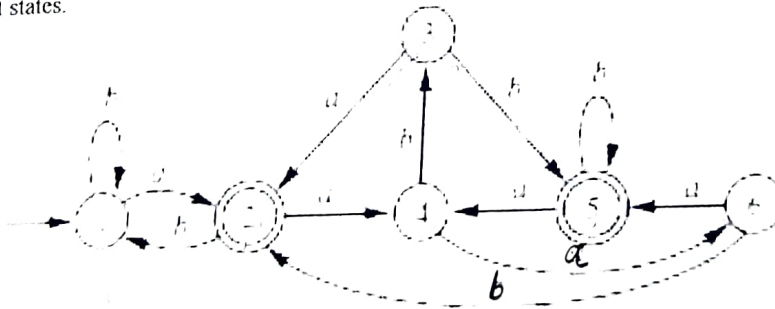


Figure 2

2. a) Prove the following for regular expressions r, s, and t. (i)  $(rs + r)^* = r(sr + r)^*$  (ii)  $(r + s)^* = (r^*s^*)^*$  (4)
- b) Write regular expressions for (i)  $L = \{w \in \{0, 1\}^* \mid w \text{ has no pair of consecutive zeros}\}$  (ii)  $L = \{vwv \mid v, w \in \{a, b\}^*, |v| = 2\}$  (4)
- c) State pumping Lemma and Prove that  $L = \{a^n b^k \mid n > k \text{ and } n \geq 0\}$  is not a regular language. (4)
3. a) Draw the leftmost derivation tree for the strings **abbba**, **abbbaabbaba** using the following production rules  $\{S \rightarrow abB, A \rightarrow aaBb \mid \epsilon, B \rightarrow bbAa\}$  (4)
- b) Construct right linear and left linear grammars for the language  $L = \{a^n b^m \mid n \geq 2 \text{ and } m \geq 3\}$  (4)
- c) Eliminate left recursion and find the language generated by the grammar with the following production rules  $\{S \rightarrow S_1 S, S_1 \rightarrow S_1 A \mid \epsilon, A \rightarrow Aa \mid b\}$  (4)



**NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI**  
**B.Tech. End Semester Exam - January 2022 SESSION**

4. a) Construct a PDA for the Language  $L = \{a^n x \mid n \geq 0, x \in \{a, b\}^* \text{ and } |x| \leq n\}$  and give the instantaneous description for the string **aaabab**. (6)

b) Give the transition rules used by the following sequence of moves:

$(q_0, aabbab, Z_0) \rightarrow (q_0, abbab, aZ_0) \rightarrow (q_0, bbab, aaZ_0)$   
 $\rightarrow (q_0, bab, baaZ_0) \rightarrow^* (q_0, bab, \delta aZ_0)$   
 $\rightarrow (q_0, ab, b\delta aZ_0) \rightarrow^* (q_0, ab, \delta Z_0) \rightarrow (q_0, b, a\delta Z_0)$   
 $\rightarrow (q_0, \Lambda, ba\delta Z_0) \rightarrow^* (q_0, \Lambda, \delta\delta Z_0) \rightarrow^* (q_0, \Lambda, \delta Z_0)$   
 $\rightarrow (q_1, \Lambda, Z_0) \rightarrow (q_1, \Lambda, Z_0)$

5. a) Construct a Turing machine to **reverse** a string  $w$  over the set of symbols  $\{a, b\}^*$  (6)  
 b) Find the language generated by the grammar with the following production rules:  $\{S \rightarrow LaR, L \rightarrow LD, Da \rightarrow aaD, DR \rightarrow R, L \rightarrow \epsilon, R \rightarrow \epsilon\}$ . Derive a string of length  $\geq 6$ . Also, mention the category of language/grammar it belongs to in Chomsky Hierarchy. (6)

\*\*\*Best Wishes\*\*\*

4. b) Find the Grammar from the transition rules

$$\delta(q_0, \lambda, z) \rightarrow \{(q_1, Sz)\}$$

$$\delta(q_1, a, S) \rightarrow \{(q_1, \lambda)\}$$

$$\delta(q_1, a, S) \rightarrow \{(q_1, AB)\}$$

$$\delta(q_1, a, A) \rightarrow \{(q_1, A)\}$$

$$\delta(q_1, a, A) \rightarrow \{(q_1, \lambda)\}$$

$$\delta(q_1, b, B) \rightarrow \{(q_1, B)\}$$

$$\delta(q_1, b, B) \rightarrow \{(q_1, \lambda)\}$$

$$\delta(q_1, \lambda, z) \rightarrow \{(q_f, z)\}$$



NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI  
B.Tech. CT-I - January 2022 SESSION

Department : Computer Science and Engineering

Date : 03/03/2022

Time: 02:30 pm

Sub Code & Title : CSPC41 Formal Languages and Automata

Duration: 1 Hour

Faculty Name : R. LEELA VELUSAMY

Max marks: 20

Answer all the questions.

1. Convert the following NFA in Figure 1 to DFA and find the regular expression of the DFA using Arden's theorem. (5)

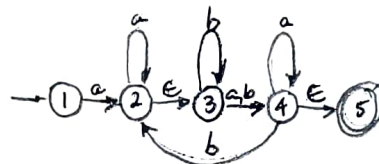


Figure 1

2. For any string  $w = w_1w_2...w_n$ , the reverse of  $w$ , written  $w^r$ , is the string in reverse order,  $w_n...w_2w_1$ . For any language  $A$ , let  $A^r = \{w^r \mid w \in A\}$ . Show that if  $A$  is regular, so is  $A^r$ . (3)
3. Figure 2 represents the finite automata for languages  $L_1$  and  $L_2$ , respectively. Draw FAs accepting the languages  $L_1 \cap L_2$  and  $L_1 - L_2$ . (4)

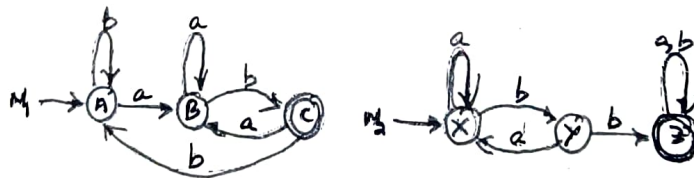


Figure 2

4. Let  $L_1 = L(a^*baa^*)$  and  $L_2 = L(aba^*)$ . Find  $L_1/L_2$  and  $L_2/L_1$ . (4)
5. Draw a Moore machine for input from  $(0/1/2)^*$  and print the residue modulo 5 of the input treated as a ternary number. (4)

\*\*\*Best Wishes\*\*\*



NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI  
B.Tech. CT-2 - January 2022 SESSION

Department : Computer Science and Engineering

Date : 04/04/2022

Time: 10:00 am

Sub Code & Title : CSPC41 Formal Languages and Automata

Duration: 1 Hour

Faculty Name : R. LEELA VELUSAMY

Max. marks 20

Answer all the questions.  
A detailed answer is expected

1. a. What is the language generated by the following CFG? (2)  
 $\{S \rightarrow SS \mid b^i T^j \mid T b^i \mid T^j T^k \mid \epsilon, T \rightarrow aS \mid SaS \mid Sa \mid a\}$   
b. Find context-free grammar generating the language  $\{a^i b^j \mid i \leq j \leq 2i\}$  (2)
2. Give a context-free grammar that generates the language  $\Lambda = \{a^i b^j c^k \mid i = j \text{ or } j = k \text{ where } i, j, k \geq 0\}$ . Is your grammar ambiguous? Why or why not? (3)
3. Consider the CFG with productions (5)  
 $\{S \rightarrow S_1 S_2, S_1 \rightarrow S_1 + T \mid T, T \rightarrow T * F \mid F, F \rightarrow [S_1] \mid a\}$   
a. Write the CFG obtained from this one by eliminating left recursion.  
b. Give a transition table for a DPDA and trace a valid string of length greater than 5
4. Find the language accepted by the PDA with the following transition rules? What is the mode of acceptance used? (4)  
 $\delta(q_0, a, Z) \rightarrow (q_1, XXZ)$   
 $\delta(q_1, a, X) \rightarrow (q_1, XXX)$   
 $\delta(q_1, c, X) \rightarrow (q_2, X)$   
 $\delta(q_2, b, X) \rightarrow (q_2, \epsilon)$   
 $\delta(q_2, \epsilon, Z) \rightarrow (q_2, \epsilon)$
5. Given the following grammar in CNF use the CYK algorithm to determine whether the string aabbb belongs to the language generated by the following production rules. (4)  
 $\{S \rightarrow AB, A \rightarrow BB|a, B \rightarrow AB|b\}$

\*\*\*Best Wishes\*\*\*



NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-620015  
B.TECH. DEGREE (FOURTH SEMESTER)  
BRANCH: COMPUTER SCIENCE AND ENGINEERING  
ASSESSMENT 3  
SUB.CODE & TITLE: CSPC43 OPERATING SYSTEMS

TIME: 10.00 am to 11.00 am      DATE: 05.04.2022      MAX. MARKS: 20

ANSWER ALL QUESTIONS

1. What are the different ways of transferring messages using IPC? Explain how parameters are passed to Send and Receive primitives in each transfer. (3)
2. What is the method used for detecting deadlocks if the resources are of single instance type? Consider the following allocation table (All resources are of single instance type):

Process ID	R1	R2	R3	R4
P1	Request	Grant	---	---
P2	Grant	---	Grant	Request
P3		Request		Request
P4			Request	Grant

Check whether there is a deadlock. (4)

3. Explain the working of the swapping process. (3)
4. What are the data structures used in Paging memory management Scheme? What are the steps involved in address translation? (3)
5. Consider the following memory allocation table.

Used	Hole	Used	Hole	Used	Hole	Used	Hole	Used	Hole	Used	Hole
10K	25K	15K	15K	10K	60k	20K	50K	5K	20K	15K	30k

Assume requests for 15K, 20K, 7K and 45K (in that order) are received. Find out the suitable blocks for the requests when the following policies are followed.

i) First fit ii) Next fit iii) Worst fit iv) Best fit. (4)

6. What is a path name? Write the steps involved in a path lookup. (3)

\*\*\*\*\*





NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-620015  
B.TECH. DEGREE (FOURTH SEMESTER)  
BRANCH: COMPUTER SCIENCE AND ENGINEERING  
ASSESSMENT 1  
SUB.CODE & TITLE: CSPC43 OPERATING SYSTEMS

TIME: 2.30 PM – 3.30 PM

DATE: 07.03.2022

MAX. MARKS: 20

ANSWER ALL QUESTIONS

1. Multiprogramming helps in executing jobs in parallel and improves utilization of resources. True or False. State reason.
2. Explain how a system call is executed in a virtual machine.
3. Draw the state transition diagram of a thread.
4. What are the actions to be performed while terminating a process?  
(4 \* 3 = 12)
5. What is a semaphore? What are its types? Explain how semaphores can be used to access the critical section.
6. Consider the following set of processes with the length of CPU burst time given in milliseconds.

Process	P1	P2	P3	P4	P5
Arrival time	0	1	3	5	6
CPU Burst Time	3	4	2	4	2

Find the schedule of the processes using the following scheduling policies: FCFS, SRT, RR (TQ = 2) and compute the Average Turnaround Time and Average Waiting Time.

(2 \* 4 = 8)

\*\*\*\*\*

**NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-15**  
**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**  
**II YEAR B.TECH , SEMESTER EXAMINATION**  
**CSPE43 ADVANCED DATA STRUCTURES AND ALGORITHMS**

**DATE: 29-04-2022**

**Duration: 2 Hrs**

**Max Marks: 30**

1. (a) Create two binomial heaps H and H1 with the following elements (Heap H: B, I, N, O, M, I, A, L, H, E, A, P) and (Heap H1: E, X, A, M, I, N, A, T, I, O, N). After constructing these two heaps, do the merging of these heaps. (3)
- (b) Construct a Min HBLT with the following elements: L, E, F, T, I, S, T, H, E, A and P. From the resultant tree, remove the smallest element. (3)
2. (a) Differentiate B-tree from B+ tree with suitable examples. (2)
- (b) What is the maximum number of keys that a B+ tree of order 3 and of height 3 have? (2)
3. (a) Give the memory representation of the segment tree for input array {1, 3, 5, 7, 9, 11}. (2)
- (b) With the suitable example, illustrate the procedure for finding the minimum element in the third dimension of KD tree. (3)
4. (a) Derive the recurrence relation for the matrix chain multiplication problem. (3)

**CYCLE TEST I**  
**COURSE CODE: HS1R13**  
**COURSE TITLE: INDUSTRIAL ECONOMICS AND FOREIGN TRADE**  
**DEPARTMENT: COMPUTER SCIENCE AND ENGINEERING**  
**SECTION B**

Max. Marks: 20

Date: 04/03/2022

Duration: 10.00 to 11.00. A.M

**PART A**  
**ANSWER ALL QUESTIONS**  
**(5\*2= 10)**

1. Define the term Marginal Rate of Technical Substitution.
2. Explain the concept of Law of Diminishing marginal utility with an example.
3. Differentiate between change in demand and shift in demand.
4. Consider the market for apple juice. In this market, the supply curve is given by  $Q_S = 10P_J - 5P_A$  and the demand curve is given by  $Q_D = 100 - 15P_J + 10P_T$ , where J denotes apple juice, A denotes apples, and T denotes tea.
  - a) Assume that  $P_A$  is fixed at \$1 and  $P_T = 5$ . Calculate the equilibrium price and quantity in the apple juice market. (2 mark)
  - b) Suppose that a poor harvest season raises the price of apples to  $P_A = 2$ . Find the new equilibrium price and quantity of apple juice. Draw a graph to illustrate your answer (2 mark)

**PART B**  
**(2\*5=10)**

5. Explain the Law of Variable proportions and its implications on the short run production function. (5 marks)
  6. Explain the concept of price elasticity its types. (5 marks)
- Use the information give in table below to answer the following questions.

Commodity	Short run	Long run
Tobacco products	-0.46	-1.89
Jewellery and Watches	-0.41	-0.67
Beer	-1.72	-2.17
Wine	-0.88	-1.17
Household natural gas(U.S)	-1.40	-2.10
Electricity(household-U.S)	-0.13	-1.89
Gasoline (Canada)	-0.15	-0.58

- a) Is the demand for electricity elastic or inelastic in the short run? In the long run? (1 mark)
- b) How much would the quantity demanded of electricity change as a result of a 10% increase in its price in the short run? In the long run? (1 mark)



**CYCLE TEST II**  
**COURSE CODE: HS1R13**  
**COURSE TITLE: INDUSTRIAL ECONOMICS AND FOREIGN TRADE**  
**DEPARTMENT: COMPUTER SCIENCE AND ENGINEERING**

**Date: 05/04/2022**  
**Duration: 2.30 to 3.30 P.M**

**Max. Marks: 20**

**PART A**  
**ANSWER ALL QUESTIONS**  
**(5\*2= 10)**

1. Define the term deadweight loss under monopoly market structure.
2. Explain the relationship between Average costs and marginal costs.
3. A profit maximizing monopoly firm with a demand curve  $P=50-Q$  is perfect price discriminator. Determine the level of output and profit, If it has marginal costs of Rs.10/unit and fixed costs of Rs.30.
4. Given the following payoff matrix, determine
  - a. whether Firm A has a dominant strategy
  - b. whether Firm B has a dominant strategy

Pay Off Matrix for a Pricing Game			
		Firm B	
Firm A	Low Price	2,2	5,1
	High Price	1,5	3,3

5. Differentiate between the terms shut down and exit.

**PART B**  
**(2\*5=10)**

6. Define monopolistic competition. Derive the long run equilibrium under monopolistic competition market structure.
7. a. Explain the features and short run equilibrium under perfect competition market structure. (3 marks)  
b. A perfectly competitive firm faces  $P=\text{Rs. } 4$  and  $TC=Q^3 - 7Q^2 + 12Q + 5$ . Find the best level of output of the firm. Also find the profit of the firm at this level of output. (2 marks)



National Institute of Technology Tiruchirappalli  
Computer Science and Engineering

B.Tech. IV Semester Section B, **Cycle Test 1**

**SUBJECT: CSPC42 - Design and Analysis of Algorithms**

**DATE: 07.03.2022, TIME: 60 MIN, Max. Marks: 20, No. of Pages:01**

1. What are the characteristics of an algorithm? (2)
2. Give the definition and graphical representation of asymptotic notations: Big Oh, Big Theta, and Big Omega. (3)
3. What are the basic asymptotic classes (time function)? List them in order. (2)
4. Use the following algorithm for solving the recurrence relation using substitution method and tree method. (4)

```
Algo Test(int n)
{
    If(n>1)
    {
        print(n);
        Test (n/2);
    }
}
```

5. Let number of jobs=9, profits  $J_1 J_2 J_3 J_4 J_5 J_6 J_7 J_8 J_9$  [15, 20, 30, 18, 18, 10, 23, 16, 25] and deadlines [7, 2, 5, 3, 4, 5, 2, 7, 3] respectively. State the design paradigm for job sequencing and find the optimal solution for the given problem. (4)
6. Compare Strassen's matrix multiplication and basic matrix multiplication. Derive the time complexity for Strassen's matrix multiplication. (5)

-----&&&-----