Mid Semester Theory Examination,
Fourth Semester- B.Tech, February, 2023

Course code: COMTC13 / CAMTC13 / CBMTC13 / CDMTC13
Course title: Probability and Stochastic Process

Time: 1 hour 30 minutes

Maximum Marks. 25

**Note: Missing data/information(if any), may be suitably assumed and mentioned in the answer.**

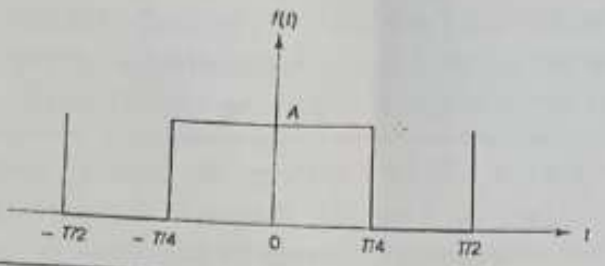
| Q. No. | Attempt all questions | Marks | CO |
|---|---|---|---|
| 1a | Sixty percent of the employees of the XYZ corporation are college graduates. Employees who did not graduate from the college, eighty percent are in sales whereas ten per cent are in sales given that they are graduates. What is the probability that an employee selected at random is neither in sales nor a college graduate? | 2.5 | CO1 |
| 1b | Let $(X_1, X_2)$ have the joint pmf as given below:<br>$(x_1, x_2)$ : (0,0) (0,2) (1,1) (1,2) (2,2)<br>$p(x_1, x_2)$ : $\frac{2}{12}$ $\frac{2}{12}$ $\frac{3}{12}$ $\frac{4}{12}$ $\frac{1}{12}$<br>Find marginal probability function of $X_1$. Further, calculate $E(2X_1 - 10)$. | 2.5 | CO1 |
| 2a | The joint frequency function of (X,Y) is given to be $f(x,y) = Ae^{-x-y}$, $0 \le x \le y \le \infty$<br>(i) Determine A. (ii) Find the marginal density function of X. | 2.5 | CO1 |
| 2b | Let $X$ be a random variable. The first four moments of $X$ about origin are 2, 136, 320, and 40,000. Find out the Kurtosis. Further, conclude the shape of the curve for the distribution followed by $X$. | 2.5 | CO1 |
| 3a | If the probability density function for a random variable $X$ is given by<br>$f_X(x) = \begin{cases} 630x^4(1-x)^4, & 0 < x < 1 \\ 0, & otherwise \end{cases}$<br>Find the probability that $X$ will take on a value within two standard deviation about the mean. | 2.5 | CO1 |
| 3b | A random variable $Y$ is defined as $\cos\pi(X)$, where $X$ has a uniform pdf over (-1/2, 1/2). Find mean and variance of random variable Y. | 2.5 | CO1 |
| 4a | The probability that a person living in a certain city own a car is 0.4. Find the probability that the tenth person interviewed in this city is $4^{th}$ one to own a car. | 2.5 | CO2 |
| 4b | The marks of 1000 students in an examination follows a normal distribution with mean 70 and standard deviation 5. Find the number of students whose marks will be (i) less than 65 (ii) more than 75. | 2.5 | CO2 |

MID-SEMESTER EXAMINATION, FEBRUARY 2023

Course Code: COECC12/CAECC12/CDECC12 Course Title: DATA COMMUNICATION

Time: 1:30 Hours Max. Marks: 15

Note: Attempt all questions. Missing data / information (if any), may be suitably assumed and mentioned in the answer.

| Q.No. | Question | Marks | CO |
|---|---|---|---|
| 1 | (a) Find the Fourier transform of a rectangular pulse 2 second long with a magnitude of 10 volts. | 1 | CO1 |
| | (b) Find the Fourier series components of the periodic wave form shown in figure   | 2 | CO1 |
| 2 | (a) What is Aperture Effect? | 1 | CO1 |
| | (b) Find the Nyquist rate and Nyquist interval for the signal<br>i. $s(t) = 6\cos 50\pi t - 10\cos 100\pi t + 20\sin 300\pi t$<br>ii. $s(t) = \frac{\sin 200\pi t}{\pi t}$ | 2 | |
| 3 | (a) A PCM system uses a uniform quantizer followed by a 7-bit binary encoder. The bit rate of the system is equal to 50 Mbps. Determine the output signal-to-quantizing noise ratio when a full load sinusoidal modulating wave of frequency 1MHz is applied to the input. | 1 | CO1 |
| | (b) Assume the quantization noise is uniformly distributed between $-\frac{\Delta}{2}$ to $\frac{\Delta}{2}$. If a sinusoidal signal of amplitude A is quantized using L level uniform quantizer derive the expression for signal to Quantization noise ratio. | 2 | CO1 |

FOURTH SEMESTER- B. TECH

MID-SEMESTER EXAMINATION, Feb-March, 2023

Course Code: CACSC10, CDCSC10, COCSC10, CMCSC10

Course Title: Theory of Automata and Formal Languages

Time: 1hr 30 mins. *Max.Marks:25*

Note: - Attempt all questions. Missing data/information (if any), may be suitably assumed and mentioned in the answer.

| | | | |
|---|---|---|---|
| Q1 | a) Explain the difference between DFA, NFA and ε-NFA. Consider the language L = {01, 11, 100}, explain the difference between L* and L+.<br>b) Consider the following NFA transition table. Convert the given NFA to minimum state DFA showing all the steps. | 2.5+2.5 | CO1, CO2 |
| Q2 | a) Construct DFA for the language accepting strings that contain at least one occurrence of each symbol over input alphabets ∑ = {a,b,c}. Write the regular expression for the same.<br>b) Draw NFA for regular expression (aa*+aba*). Consider the states name in NFA as A, B, C and so on. Convert the above-mentioned NFA into DFA | 2.5+2.5 | CO1, CO2 |
| Q3 | a) Consider the grammar<br>S-->ASA \| B<br>B-->aCb \| bCa<br>C-->ACA \| A<br>A-->a \| b \| ε<br>Find leftmost derivation, rightmost derivation and tree for the string abaaaba. Is this grammar ambiguous? Justify your answer.<br>b) What do you understand by the closure properties of Regular Languages. Explain Regular Languages are closed under which operations and how. | 2.5+2.5 | CO2 |
| Q4 | a) Prove L = {$0^n10^n$ \| n≥ 1} is regular/not regular using Pumping Lemma<br>b) State whether the Regular Expression (a+b)* = a*+b* is equivalent or not. Prove by showing examples of strings. | 2.5+2.5 | CO2 |
| Q5 | a) Construct Context free grammar G such that L(G)={w ∈ {a, b}\|w starts with a or b and ends with bbb}. Derive the string abbb using this grammar.<br>b) Construct a Mealy Machine that gives output "accept" whenever the sequence "001" is encountered in any input binary string. Convert this Mealy machine to Moore machine. | 2.5+2.5 | CO2 |

| State | 0 | 1 |
|---|---|---|
| →A | A | A, C |
| B | D | C, D |
| C | E | ---- |
| *D | E | ---- |
| *E | --- | --- |

COCSC09/CACSC09/CDCSC09/CMCSC09

Time: 1:30 Hrs. Max. Marks: 15

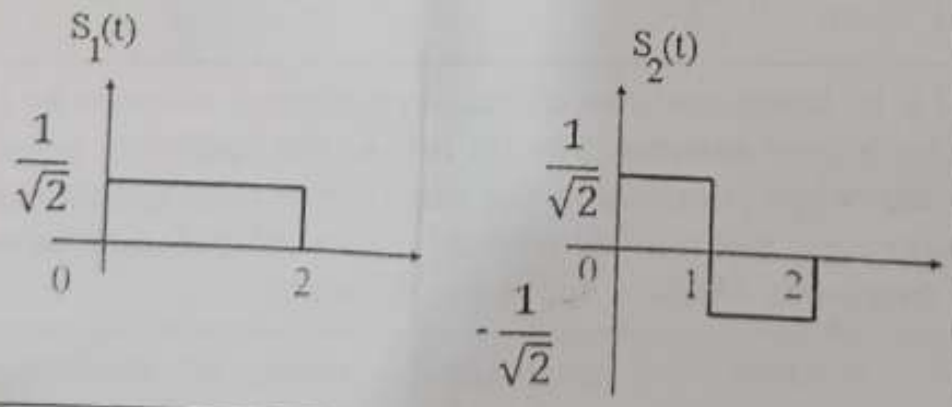
<table>
<tr><th>Q. No.</th><th>Question</th><th>Marks</th><th>CO</th></tr>
<tr><td>1a</td><td>Define an operating system. What are the underlying principles for: batch processing operating system, multiprogramming operating system and multitasking operating system.</td><td>2</td><td>CO1</td></tr>
<tr><td>1b</td><td>What are the advantages of a microkernel over a large kernel?</td><td>1</td><td>CO1</td></tr>
<tr><td>2a</td><td>Define a thread. How a multi-threaded program is better than a number of separate programs? What are multi-threading models?</td><td>2</td><td>CO2</td></tr>
<tr><td>2b</td><td>What happens to the PCB when a process shifts from the running state to the waiting state and when a process terminates?</td><td>1</td><td>CO2</td></tr>
<tr><td>3a</td><td>How the process state changes when the long-term and short-term schedulers are invoked? What are the conditions for invoking the short-term scheduler in an operating system that uses preemptive scheduling?</td><td>2</td><td>CO2</td></tr>
<tr><td>3b</td><td>A system uses preemptive priority scheduling and has five processes as follows.
<table>
<tr><th>Process</th><th>Arrival time (ms)</th><th>CPU burst time (ms)</th><th>Priority</th></tr>
<tr><td>P1</td><td>0</td><td>20</td><td>5</td></tr>
<tr><td>P2</td><td>1</td><td>10</td><td>7</td></tr>
<tr><td>P3</td><td>4</td><td>10</td><td>3</td></tr>
<tr><td>P4</td><td>10</td><td>5</td><td>0 (highest)</td></tr>
<tr><td>P5</td><td>12</td><td>10</td><td>1</td></tr>
</table>
Determine which process will have the maximum waiting time.</td><td>1</td><td>CO2</td></tr>
<tr><td>4a</td><td>What are the use of binary semaphores and counting semaphores? What are the advantages of monitors over semaphores?</td><td>2</td><td>CO2</td></tr>
<tr><td>4b</td><td>There are multiple 'writer' processes and a single 'reader' process accessing a common file in a system. Write the pseudocode for the processes.</td><td>1</td><td>CO2</td></tr>
<tr><td>5a</td><td>How deadlock prevention can be implemented by falsifying the circular wait condition?</td><td>2</td><td>CO2</td></tr>
<tr><td>5b</td><td>A system has three processes and three resource types. In the system, Available = [1 0 1], Max = $\begin{bmatrix}4 & 2 & 2\\2 & 2 & 4\\1 & 1 & 1\end{bmatrix}$, and Allocation = $\begin{bmatrix}2 & 1 & 1\\1 & 1 & 2\\0 & 1 & 0\end{bmatrix}$. Is the system in deadlock?</td><td>1</td><td>CO2</td></tr>
</table>

| | | | |
|---|---|---|---|
| 5a | Five coins are tossed and number of heads noted. The experiment is repeated 128 times and the following distribution is obtained:<br><br>No. of heads: 0 1 2 3 4 5<br>Frequencies: 8 13 19 35 30 23<br><br>Fit a binomial distribution assuming, the baised coin with the probability of tail is 1/3. | 2.5 | CO2 |
| 5b | A symmetric die is thrown 600 times. Find the lower bound for getting 80 to 120 sixes. | 2.5 | CO2 |

Standard Normal Table $P(Z \leq z)$

Table 1: Table entry for z is the area under the standard normal curve to the left of z.

| z | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 |
|---|---|---|---|---|---|---|---|---|---|---|
| -1.2 | 0.1151 | 0.1131 | 0.1112 | 0.1093 | 0.1075 | 0.1056 | 0.1038 | 0.102 | 0.1003 | 0.0985 |
| -1.1 | 0.1357 | 0.1335 | 0.1314 | 0.1292 | 0.1271 | 0.1251 | 0.123 | 0.121 | 0.119 | 0.117 |
| -1.0 | 0.1587 | 0.1562 | 0.1539 | 0.1515 | 0.1492 | 0.1469 | 0.1446 | 0.1423 | 0.1401 | 0.1379 |
| -0.9 | 0.1841 | 0.1814 | 0.1788 | 0.1762 | 0.1736 | 0.1711 | 0.1685 | 0.166 | 0.1635 | 0.1611 |
| -0.5 | 0.3085 | 0.305 | 0.3015 | 0.2981 | 0.2946 | 0.2912 | 0.2877 | 0.2843 | 0.281 | 0.2776 |
| 1.0 | 0.8413 | 0.8438 | 0.8461 | 0.8485 | 0.8508 | 0.8531 | 0.8554 | 0.9418 | 0.9429 | 0.9441 |
| 1.6 | 0.9452 | 0.9463 | 0.9474 | 0.9484 | 0.9495 | 0.9505 | 0.9515 | 0.9525 | 0.9535 | 0.9545 |
| 1.7 | 0.9554 | 0.9564 | 0.9573 | 0.9582 | 0.9591 | 0.9599 | 0.9608 | 0.9616 | 0.9625 | 0.9633 |

| | | | |
|---|---|---|---|
| 4 | (a) The source generated the bit stream 101101101. Draw the waveform for the following line codes.<br>i. AMI<br>ii. Manchester | 1 | CO2 |
| | (b) A parity check code has the parity check matrix given as<br>$\begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$<br>Suppose the received word is 110110 find whether there is any error introduced during transmission or not. If there is any error introduce, find the correct word. | 2 | CO2 |
| 5 | (a) Assume a BFSK system is being used for transmission of signals. Evaluate the performance of this modulation scheme in presence of additive white Gaussian noise with mean zero and power spectral density $\eta_0$. | 2 | CO1 |
| | (b) Check whether the following signals shown in figure below are orthonormal or not.<br>  <br> | 1 | CO1 |