

Semester-V (B. Tech.)

Number of printed page/s 01

Er. No. 2218032

Academic Year: 2024-25

Jaypee University of Engineering & Technology, Guna

T-1 (Odd Semester 2024)

18B14PH541 – Introduction to Quantum Computing

Maximum duration: 1:00 Hour

Maximum Marks: 15

Notes:

1. There are total 5 questions.
2. Write relevant answers only.
3. Do not write anything on the question paper except enrollment number.
4. Symbols used carry usual meaning.

		Marks	CO
Q1.	Recalling the total differential of Lagrangian as function of generalized co-ordinate and velocity is given as $dL = \frac{\partial L}{\partial q} dq_i + \frac{\partial L}{\partial \dot{q}} d\dot{q}$. By definition $\frac{\partial L}{\partial q} = \dot{p}$, $\frac{\partial L}{\partial \dot{q}} = p$. Derive the Hamiltonian equation.	[3]	CO1
Q2	What is a qubit? If the qubit is expressed as super position of the basis vector as $ \psi\rangle = a_0 0\rangle + a_1 1\rangle$, where $a_0 = \frac{1}{2}$, and $a_1 = \frac{\sqrt{3}}{2}$. If the measurement results into state $ 1\rangle$, what is the probability?	[3]	CO1
Q3	Analyze the linear independence of given Kets. $ u\rangle = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, $ v\rangle = \begin{bmatrix} 2 \\ 5 \\ 7 \end{bmatrix}$, and $ w\rangle = \begin{bmatrix} 1 \\ 3 \\ 4 \end{bmatrix}$.	[3]	CO2
Q4	Define Hermitian operator and demonstrate that the eigenvalues of Hermitian operator are always real.	[3]	CO1
Q5	Express the qubit $ \psi\rangle = a_0 0\rangle + a_1 1\rangle$ in spherical polar coordinate. Examine the rotation of a qubit using Bloch sphere.	[3]	CO3

Jaypee University of Engineering & Technology, Guna**T-1(Even Semester 2024)****18B11CI411 – Computer Networks**

Maximum Duration: 1 Hour

Maximum Marks: 15

Notes:

1. This question paper has 5 questions.
2. Write relevant answers only.
3. Do not write anything on question paper (Except your Er. No.).

- | | Marks | CO No. |
|---|--------------|---------------|
| Q1. Describe the function of each layer in TCP/IP and OSI reference model. | [03] | CO2 |
| Q2. Compute the number of links (cables), input out (I/O) ports, hubs/ repeaters for designing a local area network of 6 PCs. Your calculations must show the requirements of aforementioned items in each topology. Also depict your topologies containing required components with neat diagrams. | [03] | CO3 |
| Q3. Compute the latency for downloading 250MB (Megabytes) document if the bandwidth of the network is ten Mbps? The network consists of four devices including PC-1 requests a file transfer, PC-2 which receives the request from PC-1 and transfers the file, and two intermediate devices. Each intermediate device takes approximately two milliseconds for receiving and retransmitting the data, whereas the PC-2 is a busy device which takes fifty milliseconds to reply any request. Distance between the client and the server is 12,000 km. Assume signals travels at the speed of 2.5×10^8 m/s. | [03] | CO4 |
| Q4. Show the use of layers (considering TCP/IP protocol stack) at each device when data is transferred between the Client and the Server in the network shown in fig. 1. | [03] | CO3 |

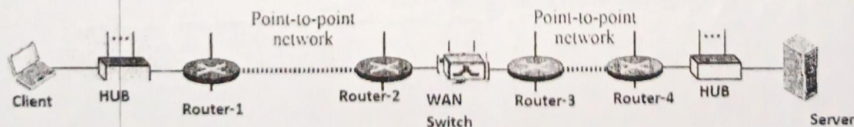


Figure 1

Q5.

Byte-stuff the following sequence of characters in which \$ is the escape byte, # is the flag byte, and T is a text data byte.

[03]

T	\$	T	T	\$	T	T	\$	#	T	#	T
	↓			↓			↓	↓		↓	

Assume the binary equivalent of above symbols as:

T → 11100111, \$ → 11001111, and # → 10000001.

What is the string actually transmitted after byte stuffing? Is it the best efficient method for framing? If no, suggest the efficient alternative method which shows the data actually transmitted and compare the efficiency in terms of extra overhead.

Jaypee University of Engineering & Technology, Guna

T-1 (Odd Semester 2024)

18B11CI511 – Theory of Computation

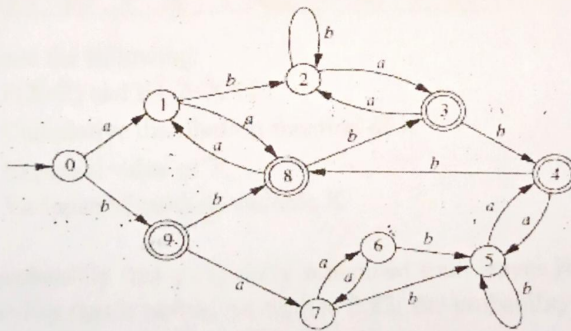
Maximum Duration: 1 Hour

Maximum Marks: 15

Notes:

1. This question paper has **four** questions.
2. Write relevant answers only.
3. Do not write anything on question paper (Except your Er. No.).

- | | | Marks | CO No. |
|-----|---|-------|--------|
| Q1. | Obtain a disjunctive normal form of $P \vee (\neg P \rightarrow (Q \vee (Q \rightarrow \neg R)))$. | [03] | CO1 |
| Q2. | Design a finite automata over $\Sigma = \{a, b\}$, accepting the strings ending with b and not containing aa . | [04] | CO1 |
| Q3. | Construct a Mealy machine that outputs 1 whenever the substring 101 is encountered, and 0 at all other times. | [04] | CO2 |
| Q4. | Minimize the given automata using table filling method. Describe each iteration of table filling method. | [04] | CO2 |



Jaypee University of Engineering & Technology, Guna**T-1 (Odd Semester- 2024)****18B11MA511 – Probability Theory and Random Processes**

Maximum Duration: 1 Hour

Maximum Marks: 15

Notes:

1. This question paper has 4 questions.
2. Write relevant answers only.
3. Do not write anything on question paper (Except your Er. No.).

- | | Marks | CO No. | | | | | | | | | | | | | | |
|---|-------|--------|-----|----|-----|----|---|-------|-----|---|-----|----|-----|----|------|-----|
| Q1. Two defective tubes get mixed up with 2 good ones. The tubes are tested one by one until both defectives are found. What is the probability that the last defective tube is obtained on:
(a) The second test
(b) The third test
(c) The fourth test | [04] | CO2 | | | | | | | | | | | | | | |
| Q2. For a certain binary communication channel, the probability that a transmitted '0' is received as a '0' is 0.95 and the probability that a transmitted '1' is received as '1' is 0.90. If the probability that a '0' is transmitted is 0.4, examine the probability that:
(a) a '1' is received
(b) a '1' was transmitted given that a '1' was received | [04] | CO5 | | | | | | | | | | | | | | |
| Q3. A random variable X has the following probability distribution:
<table border="1"><thead><tr><th>x:</th><th>-2</th><th>-1</th><th>0</th><th>1</th><th>2</th><th>3</th></tr></thead><tbody><tr><td>p(x):</td><td>0.1</td><td>K</td><td>0.2</td><td>2K</td><td>0.3</td><td>3K</td></tr></tbody></table>
Evaluate the following:
(a) $P(X < 2)$ and $P(-2 < X < 2)$
(b) Cumulative distribution function of X
(c) Expected value of X
(d) Variance of random variable X | x: | -2 | -1 | 0 | 1 | 2 | 3 | p(x): | 0.1 | K | 0.2 | 2K | 0.3 | 3K | [04] | CO5 |
| x: | -2 | -1 | 0 | 1 | 2 | 3 | | | | | | | | | | |
| p(x): | 0.1 | K | 0.2 | 2K | 0.3 | 3K | | | | | | | | | | |
| Q4. The probability that a regularly scheduled train leaves the station on time is 0.80, the probability that it arrives on time is 0.82; the probability that it departs and arrives on time is 0.75. find the probability that a train:
(a) Arrives on time given that it departed on time
(b) Departed on time given that it has arrived on time | [03] | CO3 | | | | | | | | | | | | | | |

Jaypee University of Engineering & Technology, Guna**T-1(Odd Semester 2024)****21B14HS547 – Concept of Economics**

Maximum Duration: 1 Hour

Maximum Marks: 15

Notes:

1. This question paper has 4 questions.
2. Write relevant answers only.
3. Do not write anything on question paper (Except your Er. No.).
4. Calculators are allowed.

		Marks	CO No.
Q1.	Describe the interdependencies between macroeconomic policies (such as fiscal and monetary policies) and microeconomic decision-making by firms and households. How do changes in macroeconomic policies impact the decisions made at the microeconomic level?	[04]	CO2
Q2.	Explain how monetary policy tools, such as interest rates and open market operations, influence inflation and economic growth in an economy.	[03]	CO2
Q3.	An Indian entrepreneur quits a job that pays Rs 5 lakh per year and invests Rs 10 lakh in a startup, which could alternatively be invested in government bonds yielding a 7% annual return. Calculate the opportunity cost of choosing the startup. If the startup generates a revenue of Rs 15 lakh with explicit costs of Rs 9 lakh, compute the economic profit and assess the entrepreneur's decision.	[04]	CO3
Q4.	Rajesh wants to create an education fund for his child and plans to make annual contributions to an account that offers 10% interest compounded annually. If the goal is to accumulate Rs 20 lakh in 15 years, calculate the required annual contribution. Compute the contribution needed if the investment period is extended to 20 years.	[04]	CO3
