Quiz Competition

ROUND 1

Basic Concept: 5 Marks

Round 1: Fundamental Definitions (Basic Concepts)

"This is the set of all possible outcomes of an experiment."

Answer: Sample Space (S)

Round 1: Fundamental Definitions (Basic Concepts)

"Any subset of the sample space is known as this."

Answer: Event (E)

Round 1: Fundamental Definitions (Basic Concepts)

"Two events are said to be this if the occurrence of one does not affect the probability of the other."

Answer: Independent Events

ROUND 2

Calculation & Listing: 5 Marks

Round 2: Sample Space Scramble (Calculation & Listing)

Question: An experiment consists of flipping two coins. List the sample space S.

Answer: S = {(H,H), (H,T), (T,H), (T,T)}

Round 2: Sample Space Scramble (Calculation & Listing)

Question: For the same experiment of flipping two coins, what is the probability of getting exactly one head?

Answer: P(Exactly one head) = 2/4 = 1/2

Round 2: Sample Space Scramble (Calculation & Listing)

Question: Cards numbered 1 through 5 are placed in a hat and one is drawn. Let E be the event that the number is even, and F be the event that the number is greater than 3. List the outcomes for the event $E \cup F$.

Answer: E = {2, 4}, F = {4, 5}. So, E∪F = {2, 4, 5}

ROUND 3

Critical Thinking: 5 Marks

First, choose the candidate to give answer

Round 3: True or False with Justification (Critical Thinking)
Teams must state whether the statement is True or False and provide a brief reason. (15 points for correct answer with valid justification, 5 points for correct answer only).

Statement: For any two events E and F in a sample space,
$$P(E \cup F) = P(E) + P(F).$$

Answer: False. This is only true if E and F are mutually exclusive. The general formula is $P(E \cup F) = P(E) + P(F) - P(E \cap F)$.

Round 3: True or False with Justification (Critical Thinking)
Teams must state whether the statement is True or False and provide a brief reason. (15 points for correct answer with valid justification, 5 points for correct answer only).

Statement: If two events E and F are independent, then

$$P(E \mid F) = P(E).$$

Answer: True. This is the definition of independence. The knowledge that F occurred does not change the probability of E.

Round 3: True or False with Justification (Critical Thinking)
Teams must state whether the statement is True or False and provide a brief reason. (15 points for correct answer with valid justification, 5 points for correct answer only).

Statement: If E^c represent the complement of E, then

$$P(E^c) = P(1 - E).$$

Answer: False. Since $P(S) = P(E \cup E^c) = 1$ and $E \cap E^c = \varphi$,
$P(E^c) = 1 - P(E)$.

ROUND 4

Basic Concept: 5 Marks

I will choose the candidate

Round 4: Fundamental Definitions (Basic Concepts)

“Sequence of the random variable”.

Answer: Stochastic Process

Round 4: Fundamental Definitions (Basic Concepts)

"A mathematical model for a system that evolves randomly over time".

Answer: Stochastic Process

Round 4: Fundamental Definitions (Basic Concepts)

"Random variables $\{X_n\}_{n\in T}$"

Answer: Stochastic Process

ROUND 5

Basic Concept: 15 Marks

Write the answers to paper then give to me (for all teams).

Round 5: Fundamental Definitions (Basic Concepts)

- A stochastic process $\{X(t), t \in T\}$ is a collection of _____.
- The set T is called the _____ of the process. *(which can be finite, countable or infinite)*
- The _____ of a stochastic process is defined as the set of all possible values that the random variables $X(t)$ can assume.

1 2 3

Answers:

- A stochastic process $\{X(t), t \in T\}$ is a collection of **random variables**.
- The set T is called the **index set** of the process. *(which can be finite, countable or infinite)*
- The **state space** of a stochastic process is defined as the set of all possible values that the random variables $X(t)$ can assume.

ROUND 6

Basic Concept: 15 Marks

Three answers by three different students.

Write the answer at paper (One question for all teams).

Round 6: Fundamental Definitions (Basic Concepts)

Let $\{X_n, n \in T\}$ be a stochastic process. It is a Markov chain if

(i) the future state depends only on the present state, not on the entire past history. **T/F**

(ii) it is possible to move from any state to any other state in a single step. **T/F**

(iii) If i is the present state and j be any state after that then $P_{ij} = P(X_{n+1} = j \mid X_n = i, X_{n-1} = i_{n-1}, \ldots, X_0 = i_0)$ **T/F**

Answers:

Let $\{X_n, n \in T\}$ be a stochastic process. It is a Markov chain if

(i) the future state depends only on the present state, not on the entire past history. **True**

(ii) it is possible to move from any state to any other state in a single step. **False**

(iii) If i is the present state and j be any state after that then

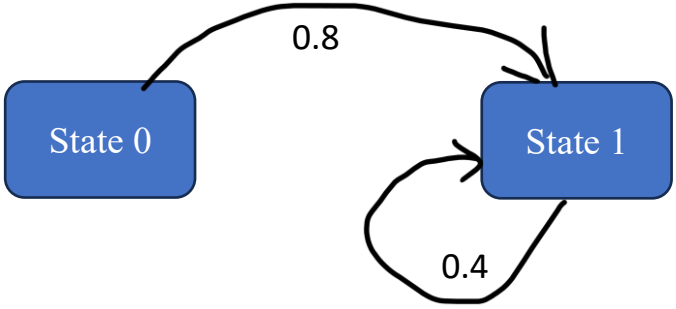
$$P_{ij} = P(X_{n+1} = j \mid X_n = i, X_{n-1} = i_{n-1}, \ldots, X_0 = i_0)$$ **True**

ROUND 7

State Transition Diagram: 5 Marks

Final Answer after Collaboration.

Round 7: State Transition Diagram

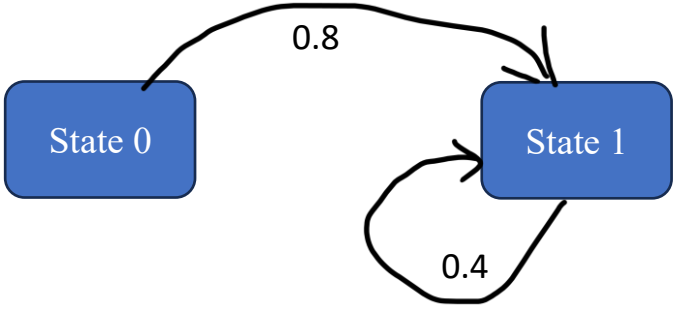


What is P_{11}?

1

Answer: $P_{11} = 0.4$

Round 7: State Transition Diagram

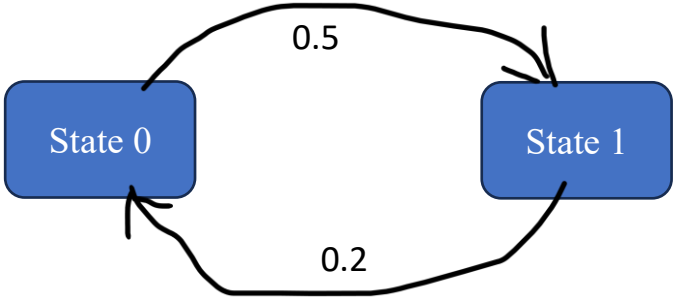


What is P_{00}?

2

Answer: $P_{00} = 0.2$

Round 7: State Transition Diagram



What is P_{11}?

3

Answer: $P_{11} = 0.8$

ROUND 8

Transition Probability Matrix: 5 Marks

The candidate will be chosen at random

Round 8: Transition Probability Matrix

Each step represents the day

$$P = \begin{bmatrix} 0.2 & 0.5 & 0.3 \\ 0.1 & 0.6 & 0.3 \\ 0.4 & 0.4 & 0.2 \end{bmatrix} \quad P^2 = \begin{bmatrix} 0.21 & 0.52 & 0.27 \\ 0.20 & 0.53 & 0.27 \\ 0.20 & 0.52 & 0.28 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.2021 & 0.5252 & 0.2727 \\ 0.2020 & 0.5252 & 0.2727 \\ 0.2020 & 0.5252 & 0.2728 \end{bmatrix}$$

What is the probability of state 0 to state 1 after 1 day?

Anwer or Can not answer from above data

Answer: $P_{01} = 0.5$

Round 8: Transition Probability Matrix

Each step represents the day

$$P = \begin{bmatrix} 0.2 & 0.5 & 0.3 \\ 0.1 & 0.6 & 0.3 \\ 0.4 & 0.4 & 0.2 \end{bmatrix} \quad P^2 = \begin{bmatrix} 0.21 & 0.52 & 0.27 \\ 0.20 & 0.53 & 0.27 \\ 0.20 & 0.52 & 0.28 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.2021 & 0.5252 & 0.2727 \\ 0.2020 & 0.5252 & 0.2727 \\ 0.2020 & 0.5252 & 0.2728 \end{bmatrix}$$

What is the probability of state 2 to state 1 after 3 days

Anwer or Can not answer from above data.

Answer: P_{21}^{3} is unknown, cannot answer.

Round 8: Transition Probability Matrix

Each step represents the day

$$P = \begin{bmatrix} 0.2 & 0.5 & 0.3 \\ 0.1 & 0.6 & 0.3 \\ 0.4 & 0.4 & 0.2 \end{bmatrix} \quad P^2 = \begin{bmatrix} 0.21 & 0.52 & 0.27 \\ 0.20 & 0.53 & 0.27 \\ 0.20 & 0.52 & 0.28 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.2021 & 0.5252 & 0.2727 \\ 0.2020 & 0.5252 & 0.2727 \\ 0.2020 & 0.5252 & 0.2728 \end{bmatrix}$$

What is the probability of state 2 to state 2 after 4 days

Anwer or Can not answer from above data.

Answer: $P_{20}^{4} = 0.2728$

THANKS

Let’s Finalize the Result