

## Course outline

How does an NPTEL online course work?

Week-0

Week-1

Week-2

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Week-10

Week-11

Week-12

Lec 63- Weighted Least Squares

Lec 64- Weighted Least Squares Example

Lec 65- Woodbury Matrix Identity – Matrix Inversion Lemma

Lec 66- Woodbury Matrix Identity – Proof

Lec 67- Conditional Gaussian Density - Mean

Lec 68- Conditional Gaussian Density - Covariance

Lec 69- Scalar Linear Model for Gaussian Estimation

Lec 70- MMSE Estimate and Covariance for the Scalar Linear Model

Quiz : Assignment-12

Feedback for Week 12

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# Assignment-12

The due date for submitting this assignment has passed.

**Due on 2021-04-14, 23:59 IST.**

As per our records you have not submitted this assignment.

 1) Consider the state sequence  $X_0, X_1, \dots, X_n$ . The Markov property states that

**1 point**

- $\Pr(X_{n+1} = s_j | X_n, X_{n-1}, \dots, X_0) = \Pr(X_{n+1} = s_j)$   
  $\Pr(X_{n+1} = s_j | X_n, X_{n-1}, \dots, X_0) = \Pr(X_{n+1} = s_j | X_n)$   
  $\Pr(X_{n+1} = s_j | X_n, X_{n-1}, \dots, X_0) = \Pr(X_{n+1} = s_j | X_0)$   
  $\Pr(X_{n+1} = s_j | X_n, X_{n-1}, \dots, X_0) = \Pr(X_n = s_j | X_{n-1}, X_{n-2}, \dots, X_0)$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $\Pr(X_{n+1} = s_j | X_n, X_{n-1}, \dots, X_0) = \Pr(X_{n+1} = s_j | X_n)$ 

 2) Consider the state sequence  $X_0, X_1, \dots, X_n$ . The time homogeneous stationary property states that

**1 point**

- $\Pr(X_{n+1} = s_j | X_n) = \Pr(X_1 = s_j | X_0)$   
  $\Pr(X_{n+1} = s_j | X_n) = \Pr(X_n = s_j | X_{n+1})$   
  $\Pr(X_{n+1} = s_j | X_n, X_{n-1}, \dots, X_0) = \Pr(X_{n+1} = s_j)$   
  $\Pr(X_{n+1} = s_j | X_n, X_{n-1}, \dots, X_0) = \Pr(X_{n+1} = s_j | X_0)$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $\Pr(X_{n+1} = s_j | X_n) = \Pr(X_1 = s_j | X_0)$ 

3) Which of the following matrices can represent the transition probability matrix for a Discrete Time Markov Chain (DTMC)

**1 point**

- $\begin{bmatrix} 0.65 & 0.25 \\ 0.35 & 0.75 \end{bmatrix}$   
  $\begin{bmatrix} 1.20 & -0.20 \\ -0.55 & 1.55 \end{bmatrix}$   
  $\begin{bmatrix} 0.25 & 0.35 \\ 0.40 & 0.10 \end{bmatrix}$   
  $\begin{bmatrix} 0.95 & 0.05 \\ 0.90 & 0.10 \end{bmatrix}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $\begin{bmatrix} 0.95 & 0.05 \\ 0.90 & 0.10 \end{bmatrix}$ 

 4) Consider a two state DTMC with  $\Pr(X_{n+1} = s_1 | X_n = s_1) = \Pr(X_{n+1} = s_1 | X_n = s_2) = 0.2$ . The transition probability matrix  $\mathbf{P}$  for this DTMC is given as

**1 point**

- $\begin{bmatrix} 0.2 & 0.2 \\ 0.8 & 0.8 \end{bmatrix}$   
  $\begin{bmatrix} 0.2 & 0.2 \\ 0.2 & 0.2 \end{bmatrix}$   
  $\begin{bmatrix} 0.2 & 0.8 \\ 0.2 & 0.8 \end{bmatrix}$   
  $\begin{bmatrix} 0.8 & 0.2 \\ 0.8 & 0.2 \end{bmatrix}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $\begin{bmatrix} 0.2 & 0.8 \\ 0.2 & 0.8 \end{bmatrix}$ 

5) The transition probability matrix of a DTMC has the property

**1 point**

- Elements in each column sum to one  
 Elements in each row are identical  
 Elements in each row sum to one  
 Elements in each column are identical

No, the answer is incorrect.

Score: 0

Accepted Answers:

Elements in each row sum to one

6) Consider a DTMC with the one-step transition probability matrix

**1 point**

$$\mathbf{P} = \begin{bmatrix} \frac{2}{3} & \frac{1}{3} \\ \frac{1}{6} & \frac{5}{6} \end{bmatrix}$$

The two-step transition probability matrix is given as

- $\begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{3}{4} & \frac{1}{4} \end{bmatrix}$   
  $\begin{bmatrix} \frac{1}{4} & \frac{3}{4} \\ \frac{1}{2} & \frac{1}{2} \end{bmatrix}$   
  $\begin{bmatrix} \frac{3}{4} & \frac{1}{4} \\ \frac{1}{2} & \frac{1}{2} \end{bmatrix}$   
  $\begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{4} & \frac{3}{4} \end{bmatrix}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $\begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{4} & \frac{3}{4} \end{bmatrix}$ 

 7) Consider the one-step transition probability matrix  $\mathbf{P}$  for a Discrete Time Markov Chain (DTMC) given as

**1 point**

$$\mathbf{P} = \begin{bmatrix} 0.45 & 0.55 \\ 0.35 & 0.65 \end{bmatrix}$$

The two step transition probability for starting from state 2 and ending in state 1 is given as

- 0.385  
 0.245  
 0.655  
 0.735

No, the answer is incorrect.

Score: 0

Accepted Answers:

0.385

 8) Consider the one step transition probability matrix  $\mathbf{P}$  for a DTMC and the stationary probability distribution  $\bar{\pi}$  such that the sum of elements of  $\bar{\pi}$  equals one. Then,  $\bar{\pi}$  is

**1 point**

- Dominant right singular vector of  $\mathbf{P}$   
 An eigenvector of  $\mathbf{P}^T$   
 Belongs to the null-space of  $\mathbf{P}$   
 Dominant left singular vector of  $\mathbf{P}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 An eigenvector of  $\mathbf{P}^T$ 

9) Consider a DTMC with the one-step transition probability matrix

**1 point**

$$\mathbf{P} = \begin{bmatrix} 0.30 & 0.7 \\ 0.8 & 0.2 \end{bmatrix}$$

The limiting distribution for this DTMC is approximately

- 0.53, 0.47  
 0.25, 0.75  
 0.34, 0.66  
 0.12, 0.88

No, the answer is incorrect.

Score: 0

Accepted Answers:

0.53, 0.47

 10) Consider the one step transition probability matrix  $\mathbf{P}$  for a DTMC. The stationary probability distribution of the DTMC is given as

**1 point**

- Each row of the matrix  $\lim_{n \rightarrow \infty} n\mathbf{P}$   
 Each column of the matrix  $\lim_{n \rightarrow \infty} \frac{\mathbf{P}}{n}$   
 Each column of the matrix  $\lim_{n \rightarrow \infty} \mathbf{P}^n$   
 Each row of the matrix  $\lim_{n \rightarrow \infty} \mathbf{P}^n$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 Each row of the matrix  $\lim_{n \rightarrow \infty} \mathbf{P}^n$