BTech II (CSE) Semester IV - Mid Semester Examination March 2021 Subject: MA 212 Linear Algebra and Statistical Analysis, Time: 9:00 - 9:45 am

* Required

Attempt All Questions

Which of the following are used for modeling times series and sequences? *

○ Decision graphs

○ Parameter tuning

○ Value of information

◉ Dynamic Bayesian networks

The nodes and links of the Bayesian network form *

◉ structural specification

○ none of these

○ multi-variable nodes

○ conditional linear Gaussian distributions

/

A dice is tossed. If X is a random variable denoting the outcome on the dice, the expected value of X is _____ *

○ 7/6

○ 6/6

◉ 7/2

○ 1/6

*

,

. The density function of X is $f(x) = \begin{cases} 2x, & \text{if } 0 \le x \le 1 \\ 0, & \text{otherwise} \end{cases}$, then $E[X^2] =$ _____

○ 1/18

○ 2

◉ 1/2

○ 2/3

In $\mathbb{R}^3$, $\alpha = (4,3,5)$, $\beta = (0,1,3)$, $\gamma = (2,1,1)$, $\delta = (4,2,2)$.
Which of the following is true?

α is not a linear combination of β and γ

Option 1

β is a linear combination of γ and δ

Option 2

α is a linear combination of β and γ

Option 3

None

The integer solution of the system of equation

$$x + 2y + z = 1$$
$$3x + y + 2z = 3$$
$$x + 7y + 2z = 1 \quad is$$

(1-3k, -k, 5k)

◉ Option 1

(-3k, -3k, 5k)

○ Option 2

(1+3k, -k, 5k)

○ Option 3

○ None

/

If X and Y are independent discrete random variables with variances 9 and 3 respectively, then Variance of [4X-2Y+6]=___ *

○ 150

○ 160

◉ 156

○ 144

○ None

*

An eigen vector corresponding to eigen value i of the matrix $A = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ is

$$\begin{pmatrix} i \\ -i \end{pmatrix}$$

○ Option 1

$$\begin{pmatrix} 1 \\ i \end{pmatrix}$$

○ Option 2

$$\begin{pmatrix} i \\ 1 \end{pmatrix}$$

◉ Option 3

○ None

What is a clique? *

○ the set of all nodes of a graph

● a set of mutually-neighboring nodes on a graph

○ a particular case of Markov chain

○ the set of all neighboring nodes

*

. The rank of $\begin{pmatrix} 1 & 0 & 3 \\ 4 & -1 & 5 \\ 2 & 0 & 6 \end{pmatrix}$ is

○ 4

○ 3

● 2

○ 1

For a continuous probability density function f which of the following holds true? *

☑ f(0.1)= c, 1≥c≥0

☑ Total area under the curve f(x)=1

☑ f(x) is bounded function

☐ f(0.1)= 0

☐ Total area under the curve f(x)≥ 1

The Bayesian network graph does not contain any cyclic graph. Hence, it is known as a *

○ DAG ●

○ DCG

○ SAG

○ CAG

Bayesian networks are a factorized representation of the full joint. *

○ False

○ can be true or false

○ none of these

● True

The condition for which the system of equations

$$x + y + z = 1$$
$$x + 2y\text{-}z = b$$
$$5x + 7y + az = b^2$$

admits a unique solution is

a=1

Option 1

a ≠ -1

Option 2

a ≠ 1

Option 3

None

*

Let the subset $S = \{(x, y, z) \in \mathbb{R}^3: x^2 + y^2 = z^2\}$ and subset
$T = \{(x, y, z) \in \mathbb{R}^3: x = z = 0\}$. Which of the following is true?

○ S is a subspace but T is not a subspace

● S is not a subspace but T is a subspace

○ Both S and T are subspaces

○ Both S and T are not subspaces

In a Bayesian network variable is? *

● both continuous and discrete

○ continuous

○ none of these

○ discrete

In the ring of 2×2 matrices over the field of real numbers, the zero element of the ring is

$\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

Option 1

$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Option 2

$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

Option 3

$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

Option 4

*

A linear mapping T: $\mathbb{R}^3 \longrightarrow \mathbb{R}^4$ is defined by

$T(x_1, x_2, x_3) = (x_2 + x_3, x_3 + x_1, x_1 + x_2, x_1 + x_2 + x_3)$, $(x_1, x_2, x_3) \in \mathbb{R}^3$.

Find Ker T?

Ker T={1}

Ker T={0}

○ Option 1   ◉ Option 2

Ker T={2}

                                          ○ None

○ Option 3

The Markov property for random field states that the conditional distribution of a pixel given all other pixels: *

◉ depends only on neighboring pixels

○ is a multivariate Gaussian distribution

○ depends only on previous pixels

○ none of these

Where does the bayes rule can be used? *

- ◉ answering the query more accurately
- ◯ solving queries
- ◯ reducing complexity
- ◯ all of the above

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*

. The exponential distribution $f(x)$ is defined by $f(x) = ae^{-2x}, 0 < x < \infty$, then $a =$ _____

- ◯ 1
- ◉ 2
- ◯ 1/2
- ◯ 0

What does the Bayesian network provides? *

- ◯ partical description of the domain
- ◉ complete description of the problem
- ◯ none of these
- ◯ complete description of the domain

*

The singleton {0} is a ring with respect to

○ Addition

○ Multiplication

⦿ Both Option 1 and Option 2

○ None

If E[X] denotes the expected value of random variable X, then following statements are always true. *

☑ E[X] is theoretical average value.

☑ E[X] is a non-negative number.

☐ E[X] is expressed in units of original data.

☐ E[X] is a location parameter.

*

If $A = \begin{pmatrix} i & 0 \\ 0 & i/2 \end{pmatrix}$, $(i = \sqrt{-1})$, then $A^{-1} = ?$

$\begin{pmatrix} i & 0 \\ 0 & i/2 \end{pmatrix}$

○ Option 1

$) \begin{pmatrix} -i & 0 \\ 0 & -2i \end{pmatrix}$

◉ Option 2

$\begin{pmatrix} i & 0 \\ 0 & 2i \end{pmatrix}$

○ Option 3

$\begin{pmatrix} 0 & i \\ 2i & 0 \end{pmatrix}$

○ Option 4

What is a Markov Random Field ? *

◉ a random process on undirected graphs

○ a Bayesian model

○ a particular case of Markov chain

○ all options correct

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