

**Time : 0**

**Correct Marks : 1**

Question Label : Multiple Choice Question

Is  $T$  an isomorphism?

**Options :**

6406532305305. ✓ Yes

6406532305306. ✗ No

## Sem2 Statistics2

<b>Section Id :</b>	64065348484
<b>Section Number :</b>	7
<b>Section type :</b>	Online
<b>Mandatory or Optional :</b>	Mandatory
<b>Number of Questions :</b>	12
<b>Number of Questions to be attempted :</b>	12
<b>Section Marks :</b>	40
<b>Display Number Panel :</b>	Yes
<b>Group All Questions :</b>	No
<b>Enable Mark as Answered Mark for Review and Clear Response :</b>	Yes
<b>Maximum Instruction Time :</b>	0
<b>Sub-Section Number :</b>	1
<b>Sub-Section Id :</b>	640653100690
<b>Question Shuffling Allowed :</b>	No
<b>Is Section Default? :</b>	null

**Question Number : 135 Question Id : 640653689018 Question Type : MCQ Is Question**

**Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction**

**Time : 0**

**Correct Marks : 0**

Question Label : Multiple Choice Question

**THIS IS QUESTION PAPER FOR THE SUBJECT "FOUNDATION LEVEL : SEMESTER II: STATISTICS FOR DATA SCIENCE II (COMPUTER BASED EXAM)"**

**ARE YOU SURE YOU HAVE TO WRITE EXAM FOR THIS SUBJECT?**

**CROSS CHECK YOUR HALL TICKET TO CONFIRM THE SUBJECTS TO BE WRITTEN.**

**(IF IT IS NOT THE CORRECT SUBJECT, PLS CHECK THE SECTION AT THE TOP FOR THE SUBJECTS REGISTERED BY YOU)**

**Options :**

6406532305307. ✓ YES

6406532305308. ✗ NO

**Question Number : 136 Question Id : 640653689019 Question Type : MCQ Is Question**

**Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction**

**Time : 0**

**Correct Marks : 0**

Question Label : Multiple Choice Question

Discrete random variables:

Distribution	PMF ( $f_X(k)$ )	CDF ( $F_X(x)$ )	$E[X]$	$\text{Var}(X)$
Uniform( $A$ ) $A = \{a, a+1, \dots, b\}$	$\frac{1}{n}, x = k$ $n = b - a + 1$ $k = a, a+1, \dots, b$	$\begin{cases} 0 & x < 0 \\ \frac{k-a+1}{n} & k \leq x < k+1 \\ & k = a, a+1, \dots, b-1, b \\ 1 & x \geq n \end{cases}$	$\frac{a+b}{2}$	$\frac{n^2-1}{12}$
Bernoulli( $p$ )	$\begin{cases} p & x = 1 \\ 1-p & x = 0 \end{cases}$	$\begin{cases} 0 & x < 0 \\ 1-p & 0 \leq x < 1 \\ 1 & x \geq 1 \end{cases}$	$p$	$p(1-p)$
Binomial( $n, p$ )	${}^n C_k p^k (1-p)^{n-k},$ $k = 0, 1, \dots, n$	$\begin{cases} 0 & x < 0 \\ \sum_{i=0}^k {}^n C_i p^i (1-p)^{n-i} & k \leq x < k+1 \\ & k = 0, 1, \dots, n \\ 1 & x \geq n \end{cases}$	$np$	$np(1-p)$
Geometric( $p$ )	$(1-p)^{k-1} p,$ $k = 1, \dots, \infty$	$\begin{cases} 0 & x < 0 \\ 1 - (1-p)^k & k \leq x < k+1 \\ & k = 1, \dots, \infty \end{cases}$	$\frac{1}{p}$	$\frac{1-p}{p^2}$
Poisson( $\lambda$ )	$\frac{e^{-\lambda} \lambda^k}{k!},$ $k = 0, 1, \dots, \infty$	$\begin{cases} 0 & x < 0 \\ e^{-\lambda} \sum_{i=0}^k \frac{\lambda^i}{i!} & k \leq x < k+1 \\ & k = 0, 1, \dots, \infty \end{cases}$	$\lambda$	$\lambda$

Continuous random variables:

Distribution	PDF ( $f_X(k)$ )	CDF ( $F_X(x)$ )	$E[X]$	$\text{Var}(X)$
Uniform $[a, b]$	$\frac{1}{b-a}, a \leq x \leq b$	$\begin{cases} 0 & x \leq a \\ \frac{x-a}{b-a} & a < x < b \\ 1 & x \geq b \end{cases}$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$
Exp( $\lambda$ )	$\lambda e^{-\lambda x}, x > 0$	$\begin{cases} 0 & x \leq 0 \\ 1 - e^{-\lambda x} & x > 0 \end{cases}$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$
Normal( $\mu, \sigma^2$ )	$\frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right),$ $-\infty < x < \infty$	No closed form	$\mu$	$\sigma^2$
Gamma( $\alpha, \beta$ )	$\frac{\beta^\alpha}{\Gamma(\alpha)} x^{\alpha-1} e^{-\beta x}, x > 0$		$\frac{\alpha}{\beta}$	$\frac{\alpha}{\beta^2}$
Beta( $\alpha, \beta$ )	$\frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)} x^{\alpha-1} (1-x)^{\beta-1}$ $0 < x < 1$		$\frac{\alpha}{\alpha+\beta}$	$\frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$

1. **Markov's inequality:** Let  $X$  be a discrete random variable taking non-negative values with a finite mean  $\mu$ . Then,

$$P(X \geq c) \leq \frac{\mu}{c}$$

2. **Chebyshev's inequality:** Let  $X$  be a discrete random variable with a finite mean  $\mu$  and a finite variance  $\sigma^2$ . Then,

$$P(|X - \mu| \geq k\sigma) \leq \frac{1}{k^2}$$

3. **Weak Law of Large numbers:** Let  $X_1, X_2, \dots, X_n \sim \text{iid } X$  with  $E[X] = \mu, \text{Var}(X) = \sigma^2$ .

Define sample mean  $\bar{X} = \frac{X_1 + X_2 + \dots + X_n}{n}$ . Then,

$$P(|\bar{X} - \mu| > \delta) \leq \frac{\sigma^2}{n\delta^2}$$

4. **Using CLT to approximate probability:** Let  $X_1, X_2, \dots, X_n \sim \text{iid } X$  with  $E[X] = \mu, \text{Var}(X) = \sigma^2$ .

Define  $Y = X_1 + X_2 + \dots + X_n$ . Then,

$$\frac{Y - n\mu}{\sqrt{n}\sigma} \approx \text{Normal}(0, 1).$$

#### Useful data:

1. Use the following values of  $F_Z$  if required:

$$F_Z\left(\frac{1}{\sqrt{5}}\right) = 0.67, F_Z\left(\frac{3}{\sqrt{5}}\right) = 0.91, F_Z(3) = 0.999, F_Z\left(\frac{-2}{\sqrt{5}}\right) = 0.19,$$

$$F_Z(0.2) = 0.58, F_Z(2) = 0.98$$

#### **Options :**

6406532305309. ✓ Useful Data has been mentioned above.

6406532305310. ✖ This data attachment is just for a reference & not for an evaluation.

<b>Sub-Section Number :</b>	2
<b>Sub-Section Id :</b>	640653100691
<b>Question Shuffling Allowed :</b>	Yes
<b>Is Section Default? :</b>	null

**Question Number : 137 Question Id : 640653689021 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 3**

Question Label : Multiple Choice Question

Let  $X$  be a continuous random variable with PDF

$$f_X(x) = \begin{cases} 4x^3, & 0 < x \leq 1, \\ 0, & \text{otherwise.} \end{cases}$$

Find the PDF of  $Y = X^3$ .

**Options :**

6406532305312. ✖

$$f_Y(y) = \begin{cases} \frac{1}{3} \left(\frac{y}{4}\right)^{1/3}, & 0 < y \leq 1, \\ 0, & \text{otherwise.} \end{cases}$$

6406532305313. ✔

$$f_Y(y) = \begin{cases} \frac{4}{3} (y)^{1/3}, & 0 < y \leq 1, \\ 0, & \text{otherwise.} \end{cases}$$

6406532305314. ✖

$$f_Y(y) = \begin{cases} \frac{1}{3} (y)^{1/3}, & 0 < y \leq 1, \\ 0, & \text{otherwise.} \end{cases}$$

6406532305315. ✖

$$f_Y(y) = \begin{cases} 4 (y)^{1/3}, & 0 < y \leq 1, \\ 0, & \text{otherwise.} \end{cases}$$

**Question Number : 138 Question Id : 640653689022 Question Type : MCQ Is Question**

**Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 3**

Question Label : Multiple Choice Question

Let  $(X, Y) \sim \text{Uniform}(D)$ , where  $D := \{(x, y) : x + y < 3, x > 0, y > 0\}$ . What is the marginal density function of  $f_X(x)$ ?

**Options :**

6406532305316. ✔

$$f_X(x) = \begin{cases} \frac{2}{9} (3 - x), & 0 < x < 3, \\ 0, & \text{otherwise.} \end{cases}$$

6406532305317. ✖

$$f_X(x) = \begin{cases} \frac{9}{2}(3-x), & 0 < x < 3, \\ 0, & \text{otherwise.} \end{cases}$$

6406532305318. ✖

$$f_X(x) = \begin{cases} 9(3-x), & 0 < x < 3, \\ 0, & \text{otherwise.} \end{cases}$$

6406532305319. ✖

$$f_X(x) = \begin{cases} 2(3-x), & 0 < x < 3, \\ 0, & \text{otherwise.} \end{cases}$$

**Question Number : 139 Question Id : 640653689024 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 3**

Question Label : Multiple Choice Question

Suppose the moment generating function of a random variable  $X$  is given by

$$M_X(\lambda) = e^{2\lambda^2}$$

Let  $X_1, X_2, X_3, X_4$  be i.i.d. samples with distribution  $X$  and  $Y$  be a random variable defined as  $Y = X_1 + X_2 + X_3 + X_4$ . Which of the following option is true?

**Options :**

6406532305321. ✖  $Y \sim \text{Normal}(0, 8)$

6406532305322. ✖  $Y \sim \text{Normal}(0, 4)$

6406532305323. ✖  $Y \sim \text{Normal}(0, 32)$

6406532305324. ✔  $Y \sim \text{Normal}(0, 16)$

**Sub-Section Number :** 3  
**Sub-Section Id :** 640653100692  
**Question Shuffling Allowed :** Yes  
**Is Section Default? :** null

**Question Number : 140 Question Id : 640653689020 Question Type : SA Calculator : None**

**Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 3**

Question Label : Short Answer Question

Suppose Manoj owns a lightbulb manufacturing company and determines that 3 out of every 75 bulbs are defective. What is the probability that he will find the first faulty bulb on the 6<sup>th</sup> one that he tested? Enter the answer correct to two decimal places.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

0.02 to 0.04

**Question Number : 141 Question Id : 640653689023 Question Type : SA Calculator : None**

**Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 3**

Question Label : Short Answer Question

A certain type of thread is manufactured with a mean tensile strength of 40 kilograms at a standard deviation of 5 kilograms. If the variance of the sample mean for a sample size of  $n_1$  is 0.0625 and the variance of the sample mean for a sample size of  $n_2$  is 0.0417, then find an approximate value for  $n_2 - n_1$ .

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range



**Text Areas :** PlainText

**Possible Answers :**

198 to 202

**Sub-Section Number :** 4

**Sub-Section Id :** 640653100693

**Question Shuffling Allowed :** No

**Is Section Default? :** null

**Question Id : 640653689025 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Question Numbers : (142 to 143)**

Question Label : Comprehension

The probability mass function of a random variable  $X$  is given as

$x$	1	2	3	4	5
$P(X = x)$	$k$	$2k$	$k^2$	$k^2$	$2k^2$

Based on the above data, answer the given subquestions.

**Sub questions**

**Question Number : 142 Question Id : 640653689026 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 2**

Question Label : Short Answer Question

Find the value of  $k$ ? Enter the answer correct to two decimal places.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

0.25

**Question Number : 143 Question Id : 640653689027 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 3**

Question Label : Multiple Choice Question

What is the value of  
 $P(1 < X < 4 | X > 2)$ ?

**Options :**

6406532305326. ✖  $\frac{1}{16}$

6406532305327. ✖  $\frac{3}{4}$

6406532305328. ✔  $\frac{1}{4}$

6406532305329. ✖  $\frac{1}{2}$

**Question Id : 640653689028 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Question Numbers : (144 to 145)**

Question Label : Comprehension

Let  $X \sim \text{Uniform}[0, 5]$  and  $g(x) = (x - 2)^2$ . Define a new random variable  $Y = g(X)$ .

Based on the above data, answer the given subquestions.

### Sub questions

**Question Number : 144 Question Id : 640653689029 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 3**

Question Label : Multiple Choice Question

Find the CDF of Y.

**Options :**

6406532305330. ✖  $F_Y(y) = \frac{2\sqrt{y}}{5}, 0 \leq y \leq 9$

6406532305331. ✖  $F_Y(y) = \frac{\sqrt{y}}{3}, 0 \leq y \leq 9$

6406532305332. ✔  $F_Y(y) = \begin{cases} \frac{2\sqrt{y}}{5}, & 0 \leq y \leq 4 \\ \frac{2 + \sqrt{y}}{5}, & 4 < y \leq 9 \end{cases}$

6406532305333. ✖  $F_Y(y) = \begin{cases} \frac{3\sqrt{y}}{10}, & 0 \leq y \leq 4 \\ \frac{2\sqrt{y} - 1}{5}, & 4 < y \leq 9 \end{cases}$

**Question Number : 145 Question Id : 640653689030 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 2**

Question Label : Short Answer Question

Find  $P(1 \leq Y \leq 6.25)$ . Enter the answer correct to one decimal place.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

0.5

**Question Id :** 640653689031 **Question Type :** COMPREHENSION **Sub Question Shuffling**

**Allowed :** No **Group Comprehension Questions :** No **Question Pattern Type :** NonMatrix

**Calculator :** None **Response Time :** N.A **Think Time :** N.A **Minimum Instruction Time :** 0

**Question Numbers :** (146 to 147)

**Question Label :** Comprehension

The joint density of two continuous random variables

$X$  and  $Y$  is given as

$$f_{XY}(x, y) = \begin{cases} e^{-(x+y)}, & 0 \leq x < \infty, 0 \leq y < \infty, \\ 0, & \text{otherwise.} \end{cases}$$

Based on the above data, answer the given subquestions.

**Sub questions**

**Question Number :** 146 **Question Id :** 640653689032 **Question Type :** MCQ **Is Question**

**Mandatory :** No **Calculator :** None **Response Time :** N.A **Think Time :** N.A **Minimum Instruction Time :** 0

**Correct Marks :** 2

**Question Label :** Multiple Choice Question

Are  $X$  and  $Y$  independent?

**Options :**

6406532305335. ✓ Yes

6406532305336. ✖ No

**Question Number : 147 Question Id : 640653689033 Question Type : SA Calculator : None**

**Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 3**

Question Label : Short Answer Question

Find the value of  $P(X < Y)$ .

Enter the answer correct to one decimal place.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

0.5

**Question Id : 640653689034 Question Type : COMPREHENSION Sub Question Shuffling**

**Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix**

**Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Question Numbers : (148 to 149)**

Question Label : Comprehension

Let  $X_1, X_2, \dots, X_n \sim \text{i.i.d. Exp}(1/3)$  and  $\bar{X} = \frac{X_1 + X_2 + \dots + X_n}{n}$ .

Based on the above data, answer the given subquestions.

**Sub questions**

**Question Number : 148 Question Id : 640653689035 Question Type : MSQ Is Question**

**Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 2 Max. Selectable Options : 0**

Question Label : Multiple Select Question

Which of the following inequalities are true w.r.t Chebyshev inequality?

**Options :**

6406532305338. ✓  $P(|\bar{X} - 3| \geq 0.25) \leq \frac{144}{n}$

6406532305339. ✗  $P(|\bar{X} - 3| \geq 0.5) \leq 1 - \frac{144}{n}$

6406532305340. ✓  $P(|\bar{X} - 3| \leq 0.5) \geq 1 - \frac{36}{n}$

6406532305341. ✗  $P(|\bar{X} - 3| \leq 0.25) \geq \frac{36}{n}$

**Question Number : 149 Question Id : 640653689036 Question Type : SA Calculator : None**

**Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 3**

Question Label : Short Answer Question

Find the minimum value of  $n$  such that the sample mean lies in  $[2.5, 3.5]$  with probability more than 0.95 using the Chebyshev inequality.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Range**

**Text Areas : PlainText**

**Possible Answers :**

718 to 722

**Question Id : 640653689037 Question Type : COMPREHENSION Sub Question Shuffling**

**Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix**

**Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Question Numbers : (150 to 151)**

Question Label : Comprehension

In a telecom system, each data file consists of 500 bits. Due to noise, each data bit received may have an error with probability 0.1. It is assumed that bit errors occur independently.

Based on the above data, answer the given subquestions.

**Sub questions**

**Question Number : 150 Question Id : 640653689038 Question Type : MCQ Is Question**

**Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 2**

Question Label : Multiple Choice Question

Suppose  $Y$  represents the total number of bits without an error in a certain data file. Which of the following is true?

**Options :**

6406532305343. ✘  $Y \sim \text{Bernoulli}(0.9)$

6406532305344. ✘  $Y \sim \text{Bernoulli}(0.1)$

6406532305345. ✔  $Y \sim \text{Binomial}(500, 0.9)$

6406532305346. ✘  $Y \sim \text{Binomial}(500, 0.1)$

**Question Number : 151 Question Id : 640653689039 Question Type : SA Calculator : None**

**Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 3**

Question Label : Short Answer Question

Using Central limit theorem, find the approximate probability that there are more than 53 errors in a certain data file. Enter the answer correct to two decimal places.

**Response Type** : Numeric

**Evaluation Required For SA** : Yes

**Show Word Count** : Yes

**Answers Type** : Range

**Text Areas** : PlainText

**Possible Answers** :

0.30 to 0.36