

Unless otherwise stated, assume that we consider the usual vector addition and scalar multiplication. Choose the correct option(s) from the following statements.

**Options :**

6406532238268. ✖ The set of vectors  $\{(a, b) \in \mathbb{R}^2\}$  with scalar multiplication defined by  $k(a, b) = (0, kb)$  forms a vector space.

6406532238269. ✖ The set of real numbers with addition defined by  $x + y := x - y$  forms a vector space.

6406532238270. ✔ Let  $A \in \mathbb{R}^{3 \times 3}$  be an invertible matrix. The set of all solutions of the homogeneous system  $AX = 0$  is a vector space of dimension 0.

6406532238271. ✔ Any vector subspace of  $\mathbb{R}^2$  with dimension 1 is of the form  $ax + by = 0$  where  $a \neq 0$  or  $b \neq 0$ .

6406532238272. ✖ Any vector subspace of  $\mathbb{R}^3$  with dimension 1 is of the form  $ax + by = c$  where  $a \neq 0$  or  $b \neq 0$ .

6406532238273. ✔  $V = \left\{ \begin{pmatrix} a & b \\ c & d \end{pmatrix} : a + b = c + d \right\}$  forms a vector space.

6406532238274. ✔ The set of all  $n \times n$  matrices with rank strictly less than  $n$  does not form a vector space.

## Sem2 Statistics2

Section Id :	64065344877
Section Number :	7
Section type :	Online
Mandatory or Optional :	Mandatory

Number of Questions :	12
Number of Questions to be attempted :	12
Section Marks :	40
Display Number Panel :	Yes
Section Negative Marks :	0
Group All Questions :	No
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0
Sub-Section Number :	1
Sub-Section Id :	64065395009
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Number : 147 Question Id : 640653667963 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 :**

6406532238275.  YES

6406532238276.  NO

**Question Number : 148 Question Id : 640653667964 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( $n, p$ )	${}^nC_k p^k (1-p)^{n-k},$ $k = 0, 1, \dots, n$	$\begin{cases} 0 & x < 0 \\ \sum_{i=0}^k {}^nC_i p^i (1-p)^{n-i} & k \leq x < k+1 \\ & k = 0, 1, \dots, n \\ 1 & x \geq n \end{cases}$	$np$	$np(1-p)$
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,

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

**Options :**

6406532238277.  Useful Data has been mentioned above.

6406532238278.  This data attachment is just for a reference & not for an evaluation.

**Sub-Section Number :**

2

**Sub-Section Id :**

64065395010

**Question Shuffling Allowed :**

Yes

**Is Section Default? :**

null

**Question Number : 149 Question Id : 640653667965 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  $X \sim \text{Bernoulli}(1/3)$ ,  $Y \sim \text{Bernoulli}(1/2)$ , and  $Z \sim \text{Bernoulli}(2/3)$  such that  $f_{XYZ}(0,0,1) = \frac{1}{4}$ , and  $f_{Z|Y=1}(0) = \frac{1}{3}$ . Find the value of  $f_{X|Y=0,Z=1}(0)$ . 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 :**

0.75

**Question Number : 150 Question Id : 640653667972 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

The joint PMF of two discrete random variables  $X$  and  $Y$  is given in the following table:

$Y \backslash X$	0	1
0	$\frac{1}{12}$	$\frac{1}{6}$
1	$\frac{1}{6}$	$\frac{1}{3}$
2	$\frac{1}{12}$	$\frac{1}{6}$

Find the value of  $\text{Cov}(X, Y)$ .

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

0

**Question Number : 151 Question Id : 640653667973 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

Consider a function  $f : \mathbb{R} \rightarrow \mathbb{R}$  such that

$$f(x) = \begin{cases} cx^2, & 1 \leq x < 2, \\ cx, & 2 \leq x < 4, \\ 0, & \text{otherwise,} \end{cases}$$

where  $c$  is any real constant. Find  $c$  such that the function  $f$  is a valid density function.

Enter the answer correct to two decimal places.

Hint:  $\int x^k dx = \frac{x^{k+1}}{k+1}$

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

0.10 to 0.14

**Sub-Section Number :** 3

**Sub-Section Id :** 64065395011

**Question Shuffling Allowed :** No

**Is Section Default? :** null

**Question Id : 640653667966 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 : (152 to 153)**

Question Label : Comprehension

A fair six - sided die is marked '1' on one face, '2' on two of its faces, and '3' on the remaining three faces. The die is thrown twice. Let a random variable  $X$  denote the number obtained on the first throw and let a random variable  $Y$  denote the number obtained on the second throw. Define a new random variable  $Z = X + Y$ .

Based on the above data, answer the given subquestions.

**Sub questions**

**Question Number : 152 Question Id : 640653667967 Question Type : MCQ Is Question**

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

**Correct Marks : 1**

Question Label : Multiple Choice Question

Find the range of  $Z$ .

**Options :**

6406532238280. ✖  $T_Z = \{1, 2, 3, 4, 5, 6\}$

6406532238281. ✖  $T_Z = \{1, 2, 3\}$

6406532238282. ✔  $T_Z = \{2, 3, 4, 5, 6\}$

6406532238283. ✖  $T_Z = \{2, 3, 4, 5\}$

**Question Number : 153 Question Id : 640653667968 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

Find the value of  $P(Z = 3)$ .

**Options :**

6406532238284. ✖  $\frac{1}{18}$

6406532238285. ✖  $\frac{1}{6}$

6406532238286. ✔  $\frac{1}{9}$

6406532238287. ✖  $\frac{1}{3}$

**Question Id : 640653667969 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 : (154 to 155)**

Question Label : Comprehension

A box contains 7 milk chocolates and 3 dark chocolates. Two chocolates are drawn at random one after another without replacement from the box. Let a random variable  $X$  denote the number of milk chocolates drawn.

Based on the above data, answer the given subquestions.

### Sub questions

**Question Number : 154 Question Id : 640653667970 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

What is the PMF of  $X$ ?

**Options :**



6406532238288. ✓

$x$	0	1	2
$P(X = x)$	1/15	7/15	7/15

6406532238289. ✖

$x$	0	1	2
$P(X = x)$	7/15	1/15	7/15

6406532238290. ✖

$x$	1	2
$P(X = x)$	1/2	1/2

6406532238291. ✖

$x$	1	2
$P(X = x)$	7/10	3/10

**Question Number : 155 Question Id : 640653667971 Question Type : SA Calculator : None**

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

**Correct Marks : 1**

Question Label : Short Answer Question

Find the expected value of  $X$ ? Enter the answer correct to one decimal place.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

1.3 to 1.5

**Sub-Section Number :**

Sub-Section Id :

64065395012

Question Shuffling Allowed :

No

Is Section Default? :

null

Question Id : 640653667974

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 : (156 to 157)

Question Label : Comprehension

The joint PMF of two discrete random variables  $X$  and  $Y$  is

$$f_{XY}(x,y) = \begin{cases} \frac{1}{27}(2x+y), & x,y \in \{0,1,2\}, \\ 0, & \text{otherwise.} \end{cases}$$

Based on the above data, answer the given subquestions.

Sub questions

Question Number : 156

Question Id : 640653667975

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

Identify the correct joint PMF table of  $X$  and  $Y$ :

Options :

<div><div><div><div></div><div></div></div></div><div><div><div><div></div><div></div></div></div><div><div><div><div></div><div></div></div></div></div><div><div><div><div></div><div></div></div></div><div><div><div><div></div><div></div></div></div></div><div><div><div><div></div><div></div></div></div></div></div></div></div>	0	1	2
0	0	$\frac{2}{27}$	$\frac{4}{27}$
1	$\frac{1}{27}$	$\frac{3}{27}$	$\frac{5}{27}$
2	$\frac{2}{27}$	$\frac{4}{27}$	$\frac{6}{27}$

6406532238295. ✓

6406532238296. ✖

$Y \backslash X$	0	1	2
0	0	$\frac{2}{27}$	$\frac{4}{27}$
1	$\frac{2}{27}$	$\frac{4}{27}$	$\frac{6}{27}$
2	$\frac{1}{27}$	$\frac{3}{27}$	$\frac{5}{27}$

6406532238297. ✖

$Y \backslash X$	0	1	2
0	0	$\frac{1}{27}$	$\frac{2}{27}$
1	$\frac{2}{27}$	$\frac{3}{27}$	$\frac{4}{27}$
2	$\frac{4}{27}$	$\frac{5}{27}$	$\frac{6}{27}$

6406532238298. ✖

$Y \backslash X$	0	1	2
0	0	$\frac{2}{27}$	$\frac{2}{27}$
1	$\frac{2}{27}$	$\frac{3}{27}$	$\frac{5}{27}$
2	$\frac{3}{27}$	$\frac{4}{27}$	$\frac{6}{27}$

**Question Number : 157 Question Id : 640653667976 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  $P(X + Y \leq 2 \mid X > 0)$ . 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 :**

0.35 to 0.40

**Question Id :** 640653667977 **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 :** (158 to 159)

**Question Label :** Comprehension

An unbiased coin is tossed three times independently. Let  
 $X$  represent the number of heads in all three tosses,  
 $Y$  represent the number of tails in the first two tosses.  
Define another random variable  $U = XY$ .

Based on the above data, answer the given subquestions.

**Sub questions**

**Question Number :** 158 **Question Id :** 640653667978 **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 PMF of  $U$ .

**Options :**

$u$	0	1	2
$f(u)$	1/4	1/4	1/2

6406532238300. ✖

6406532238301. ✖

$u$	0	1	2	3
$f(u)$	1/8	1/4	1/2	1/8

6406532238302. ✓

$u$	0	1	2
$f(u)$	3/8	1/4	3/8

6406532238303. ✖

$u$	0	2
$f(u)$	1/4	3/4

Question Number : 159 Question Id : 640653667979 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

If  $P(U = a|U \geq 1) = \frac{2}{5}$ , then find the value of  $a$ .

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Id : 640653667980 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 : (160 to 161)

Question Label : Comprehension

A fair die is thrown two times independently. Let

$X_1$  represent the number obtained in the 1st throw,

$X_2$  represent the number obtained in the 2nd throw,

Define a new random variable  $X$  such that

$$X = \max(X_1, X_2)$$

Based on the above data, answer the given subquestions.

### Sub questions

Question Number : 160 Question Id : 640653667981 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

Compute the CDF of  $X$ ,  $F_X(k)$ ,

where  $k \in \{1, 2, 3, 4, 5, 6\}$ .

Options :

6406532238305. ✖  $F_X(k) = \left(\frac{k}{6}\right)$

6406532238306. ✖  $F_X(k) = \left(\frac{1}{6}\right)^2$

6406532238307. ✖  $F_X(k) = \left(\frac{k+1}{6}\right)^2$

6406532238308. ✔  $F_X(k) = \left(\frac{k}{6}\right)^2$

**Question Number : 161 Question Id : 640653667982 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  $P(X = 4)$ . 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 :**

0.16 to 0.22

**Question Id : 640653667983 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 : (162 to 163)**

Question Label : Comprehension

Suppose  $X \sim \text{Poisson}(\lambda)$ .

Based on the above data, answer the given subquestions.

**Sub questions**

**Question Number : 162 Question Id : 640653667984 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 value of  $\lambda$  for which  $3P(X = 3) = 2P(X = 2) + 4P(X = 1)$ .

**Options :**

6406532238310.

✖ 2

6406532238311. ✔ 4

6406532238312. ✖ 1

6406532238313. ✖ 0.5

**Question Number : 163 Question Id : 640653667985 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

Using Chebyshev's inequality, find a lower bound for  $P(-2\sigma \leq X - \mu \leq 2\sigma)$ , where  $\mu$  and  $\sigma^2$  are mean and variance of  $X$ , respectively. 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 :**

0.75

**Question Id : 640653667986 Question Type : COMPREHENSION Sub Question Shuffling**

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

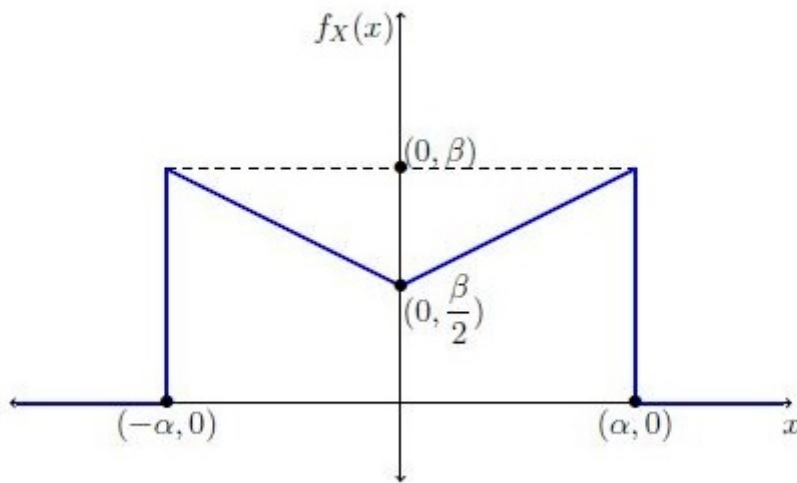
**Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Question Numbers : (164 to 165)**

Question Label : Comprehension



The graph of a probability density function ( $f_X(x)$ ) of a continuous random variable ( $X$ ) is shown below ( $\alpha, \beta \in \mathbb{R}$ ):



Graph of the pdf of  $X$

Based on the above data, answer the given subquestions.

### Sub questions

**Question Number : 164 Question Id : 640653667987 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

Which of the following is true?

**Options :**

6406532238315. ✖  $\alpha\beta = 1$

6406532238316. ✔  $\alpha\beta = \frac{2}{3}$

6406532238317. ✖  $\alpha\beta = 2$

6406532238318. ✖  $\frac{1}{\alpha} + \frac{1}{\beta} = 1$

**Question Number : 165 Question Id : 640653667988 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  $P\left(|X| < \frac{\alpha}{2}\right)$ . 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 :**

0.39 to 0.45

## Sem2 Intro to Python

Section Id :	64065344878
Section Number :	8
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	15
Number of Questions to be attempted :	15
Section Marks :	50
Display Number Panel :	Yes
Section Negative Marks :	0
Group All Questions :	No
Enable Mark as Answered Mark for Review and	
Clear Response :	Yes