D 92886 (Pages : 3) Name.................................

Reg. No...............................

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2015

(CUCBCSS—UG)

Complementary Course

STS 1C 01—BASIC STATISTICS AND PROBABILITY

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions in* **one** *words.*
Each question carries 1 *mark.*

Fill up the blanks :

1 Sum of squares of deviations of the observations is minimum when it is taken about their ————————.

2 Standard deviation of $x_1, x_2, \ldots, x_n$ is k. Then the standard deviation of the set $x_1 + a, x_2 + a, \ldots, x_n + a$, where a is a constant is ————————.

3 For two non negative observations x_1, x_2, A.M. X H.M. = ————————.

4 For two mutually exclusive events A and B, P (A∪B) = ————————.

5 Geometric mean of regression coefficients gives the absolute value of ————————.

Write true *or* false :

6 Average speed is calculated using harmonic mean.

7 If A and B are independent, $P(A \cap B) = P(A) + P(B)$.

8 Pearson's coefficient of correlation between two variables X and Y is $\frac{\text{Cov}(X, Y)}{V(X)\,V(Y)}$.

9 Geometric mean is one of the measures of central tendency.

10 The point of intersection of regression lines gives the means of the variables.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions in* **one** *sentence each.*
Each one carries 2 *marks.*

11 Define mutually exclusive events.

12 Three coins each with the sides denoted by H and T are tossed. What is the sample space ?

13 A card is drawn from a deck of 52 cards. What is the probability that the card drawn is an ace *or* a spade ?

Turn over

14 Define a random variable.

15 State the multiplication theorem on probability for three events A, B and C.

16 Distinguish between population and sample.

17 Define dispersion.

(7 × 2 =14 marks)

Section C

Answer any **three** *questions.*
Each **one** *carries 4 marks.*

18 In a group of n the mean age of men and women is 30 years. If the mean age of x men is 32 and $(n - x)$ women is 27, find the percentage of men in the group.

19 Given the regression lines $14x + 12y - 3 = 0$ and $12x + 21y + 10 = 0$. Identify the regression lines.

20 For an event A, using frequency definition prove that, $0 \le P(A) \le 1$.

21 Define probability density function and state its properties.

22 A and B are independent events in the sample space S. Show that (i) A^C and B ; (ii) A^C and B^C are also independent.

(3 × 4 =12 marks)

Section D

Answer any **four** *questions.*
Each **one** *carries 6 marks.*

23 Define partition values. Describe important partition values and their inter relations.

24 Using principle of least squares, explain the fitting of straight line connecting the variables X and Y.

25 Derive spearman's rank correlation coefficient.

26 A,B and C toss a coin in succession on the rule that the first one to throw a head wins. What are the probabilities of winning of A, B and C ?

27 Given the p.d.f. of a non-negative random variable $f(x) = \frac{1}{5} e^{-\frac{1}{5}x}, x > 0,$ prove that $P(X > 5 / X > 2) = P(X > 3)$.

28 Given $f(x) = \begin{cases} 1 & , \quad 0 < x < 1 \\ 0 & , \quad \text{otherwise} \end{cases}$ as the p.d.f. of X. Obtain the p.d.f. of $Y = -2 \log_e X$.

(4 × 6 = 24 marks)

Section E

*Answer any **two** questions.*
*Each **one** carries 10 marks.*

29 Define coefficient of variation. Among the following *two* series of observations, identify which series is more consistent.

Class :	0—10	10—20	20—30	30—40	40—50	50—60	60—70
Series A :	1	2	9	8	5	4	1
Series B :	1	3	7	8	7	3	1

30 Show that $-1 \leq r_{xy} \leq 1$, where r_{xy} is Pearson's coefficient of correlation.

31 State Bayes' theorem. 0.5% of the population of a city is suffering from a particular disease. A person suffering from this disease has 95% chances to be tested as positive. The chance for a wrong positive test result is 1%. What is the chance for a person actually to have the disease, if that person is tested positive ?

32 A fair coin is tossed three times. (i) Obtain the probability distribution of the total number of heads (X) obtained (ii) Distribution function F(x) of X (iii) Sketch the graph of F(x) and (iv) Find P (X > 2).

(2 × 10 = 20 marks)

D 13838 (Pages : 4) Name..............................

Reg. No..............................

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2016

(CUCBCSS—UG)

Complementary Course

STS 1C 01—BASIC STATISTICS AND PROBABILITY

Time : Three Hours

Maximum : 80 Marks

Section A

Answer **all** *questions in one word.*
Each question carries 1 mark.

Fill up the blanks :

1. Geometric mean is not suitable if any value of the set is ————.
2. Median and ———— Percentile are same.
3. If $r_{xy} = \pm 1$, the angle between the regression lines is ————.
4. If, $A \subset B$, $P\left(A \cap B^c\right) =$ ————.
5. For any *two* event A and B, $P(A/B) + P\left(A^c/B\right) =$ ————.

Write true *or* false :

6. Mode is a positional average.
7. Total ; numbers of percentiles are 100.
8. If A in independent of B and B independent of C, then A in independent of C.
9. Probability density function $f(x)$ is always non-negative.
10. If A and B are independent, $P\left(A \cap B^c\right) = P(A)\ P\left(B^c\right)$.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions in one sentence each.*
Each one carries 2 marks.

11. Define harmonic mean.
12. Define deciles.

13. The mean and standards deviation of a variable X are m and n respectively. Write the mean and standard deviation of Y, where $Y = aX + b$.

14. If $r_{12} = 0.93$, $r_{13} = 0.99$ and $r_{23} = 0.92$, calculate $r_{12.3}$.

15. State the frequency, definition of probability.

16. 40 % of the students in a campus are girls. If 20 % of girls and 16 % of boys are Arts students, what percentage of all the students are Arts students ?

17. State the properties of distribution function of a discrete random variable.

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*
Each one carries 4 *marks.*

18. Write a note on rank correlation coefficient.

19. Given the regression lines $9x - 4y + 15 = 0$ and $25x - 6y - 7 = 0$. Find the coefficient of correlation between X and Y.

20. Define conditional probability. 15 % of the population of a country is unemployed women, and a total of 25 % are unemployed. What percentage of unemployed are women ?

21. State the multiplication theorem on probability for two events A and B. Two defective fuses and 5 good fuses are mixed. Decided to test the fuses one by one without replacement. What is the probability to obtain both the defective fuses in first two tests ?

22. Find k, if $f(x) = kx^4e^{-x}$, for $0 < x < \infty$ is a probability density function.

(3 × 4 = 12 marks)

Section D

Answer any **four** *questions.*
Each one carries 6 *marks.*

23. Calculate the quartile deviation for the following data :

Class :	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70
Frequency :	6	5	8	15	7	6	3

24. Using principle of least squares, explain the fitting of the curve of the form $y = ae^{bx}$.

25. Derive an expression for the angle between *two* regression lines.

26. Obtain the distribution function of a random variable X denoting the sum of the numbers shown when two unbiased dies are thrown.

27. Given the p.d.f. of a random variable X, $f(x) = \begin{cases} kx, \text{ for } 0 < x < 1 \\ k, \text{ for } 1 < x < 2 \\ -kx + 3k, \text{ for } 2 < x < 3 \\ 0, \text{ elsewhere.} \end{cases}$

Find (i) k. (ii) $P(X > 2)$. (iii) $P(X < 2/X > 1)$.

28. Given $f(x) = \begin{cases} e^{-x}, x > 0 \\ 0, \text{ otherwise} \end{cases}$ as the p.d.f. of X. Obtain the p.d.f. of $Y = e^{-x}$.

(4 × 6 = 24 marks)

Section E

Answer any **two** *questions.*
Each one carries 10 *marks.*

29. An investigation on the average life of a number of two types of machines gives the following data

Life (in years) :	0 – 2	2 – 4	4 – 6	6 – 8	8 – 10	10 – 12
Type A :	5	16	13	7	5	4
Type B :	2	7	12	19	9	1

Compare the consistency in life length of the given models.

30. (a) Write a note on correlation and regression analysis.

(b) Derive equations of regression lines passing through the points $(x_1 - y_1), (x_2, y_2), \ldots, (x_n, y_n)$.

(c) Identify their point of intersection.

31. (a) State Bayes' theorem.

(b) 25 % of the paintings displayed in a gallery are not original. In 15 % of the cases the buyer makes a mistake of identifying whether the painting is original or copy. If one buys a painting thinking that it is original, what is the probability that it is not ?

32. Given the distribution function of X as,

$$F(x) = \begin{cases} 0, & \text{for } x < 0 \\ kx^2, & \text{for } 0 \le x < 3 \\ k\left(-x^2 + 12x - 18\right) & \text{for } 3 \le x < 6 \\ 1, & \text{for } x \ge 6 \end{cases}$$

(a) Obtain the p.d.f. of X.

(b) Find k.

(c) Find $P(2 < X < 4)$.

(d) Find $P(X > 2 / X < 5)$.

(2 × 10 = 20 marks)

C 33354 **(Pages : 3)** **Name..**

Reg. No.......................................

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2017

(CUCBCSS—UG)

Complementary Course

STS 1C 01—BASIC STATISTICS AND PROBABILITY

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions in* **one word.**
Each question carries 1 *mark.*

Fill up the blanks :

1. Two sets of observations with number of elements 10 and 15 respectively, the means are 5 and 10. The mean of these 25 observations taken together is ————.
2. Harmonic mean of 10 and 15 is ————.
3. If $r_{xy} = 0$, the angle between the regression lines is ————.
4. For two events A and B, $P(A \cup B) = 0.6 = 2P(A \cap B)$; then, $P(A) + P(B) =$ ————.
5. If A and B are mutually exclusive, $P(A/B) =$ ————.

Write True *or* False :

6. Mode is a positional average.
7. If A and B are exhaustive, $P(A \cup B) = 1$.
8. Rank correlation coefficient is used in case of qualitative variables.
9. It is possible to find range for data given in grouped frequency table with open ended classes.
10. Both the regression coefficients are always having the same sign.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions in* **one sentence** *each.*
Each one carries 2 *marks.*

11. Define central tendency.
12. Define geometric mean.
13. Obtain the standard deviation of first *n* natural numbers.
14. Define partition of sample space.

Turn over

15. Define probability space.

16. For two events A and B, $P(A) = 1/3, P(B) = 1/4, P(A \cup B) = 1/3$. Find $P(B/A)$.

17. Two fair dice are thrown. Find the probability that the sum of the numbers shown is more than 10.

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*
Each one carries 4 *marks.*

18. The mean and standard deviation of a variable X are m and n respectively. Obtain the mean and standard deviation of Y, where $Y = aX + b$.

19. Given the regression lines $9x - 4y + 15 = 0$ and $25x - 6y - 7 = 0$. Find the means of the variables.

20. For two events A and B, $P(A) = 0.3, P(B) = p, P(A \cup B) = 0.8$. Find p if A and B are independent.

21. Define probability mass function and state its properties.

22. Find k, if $f(x) = k\left(\frac{2}{3}\right)^x$, $x = 1, 2, \ldots$ is a probability mass function.

(3 × 4 = 12 marks)

Section D

Answer any **four** *questions.*
Each one carries 6 *marks.*

23. Obtain the mean deviation about mean for the following data :

Class	:	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	:	6	5	8	15	7	6	3

24. Using principle of least squares, explain the fitting of the curve of the form $y = ab^x$.

25. Derive Spearman's rank correlation coefficient.

26. For any *two* events A and B, prove that :

(i) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.

(ii) $P\left[\left(A \cap B^c\right) \cup \left(A^c \cap B\right)\right] = P(A) + P(B) - 2P(A \cap B)$.

27. Given the p.d.f. of a random variable X, $f(x) = \begin{cases} kx, & \text{for } 0 < x < 1 \\ k, & \text{for } 1 < x < 2 \\ -kx + 3k, & \text{for } 2 < x < 3 \\ 0, & \text{elsewhere} \end{cases}$. Find (i) k ; (ii) F(x).

28. Given $f(x) = \begin{cases} e^{-x}, x > 0 \\ 0, \text{otherwise} \end{cases}$ as the p.d.f. of X. Obtain the p.d.f. of $Y = e^{-x}$.

(4 × 6 = 24 marks)

Section E

Answer any **two** *questions.*
Each one carries 10 *marks.*

29. Define coefficient of variation. 2 cities shows the following prices for a particular commodity recorded over 5 weeks.

City A	:	20	22	19	22	23
City B	:	18	12	10	20	15

Compare the consistency in the prices for these two cities.

30. (i) Write a note on correlation.

(ii) Show that Pearson's coefficient of correlationr r_{xy}, is independent of linear transformation.

31. (i) Define conditional probability.

(ii) State and prove Bayes' theorem.

32. Given the distribution function of X as,

$$F(x) = \begin{cases} 0, \text{ for } x < 0 \\ \frac{x^2}{2}, \text{ for } 0 \le x < 1 \\ \frac{1}{2} + k(4x - x^3 - 3), \textit{ for } 1 \le x < 2 \\ 1, \text{ for } x \ge 2 \end{cases}$$

(i) Obtain the p.d.f. of X.

(ii) Find k.

(iii) A and B are events denoting $\left(\frac{1}{2} < X < \frac{3}{2}\right)$ and $(X > 1)$ respectively. Verify whether A and B are independent.

(2 × 10 = 20 marks)

D 52791 (Pages : 4) Name.....................................

Reg. No.....................................

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2018

(CUCBCSS—UG)

Complementary Course (Statistics)

STS 1C 01—BASIC STATISTICS AND PROBABILITY

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions in* **one word.**
Each question carries 1 *mark.*

Fill up the blanks :

1. Let A and B be two events such that $P(A) = 0.3$ and $P(A \cup B) = 0.79$. If A and B are independent events, then $P(B) =$ ————.
2. The type of sampling in which each unit of the population has an equal chance of being included in the sample is called ————.
3. Let b_1 and b_2 are the regression coefficients, then the correlation coefficient is ————.
4. A coin is tossed three times in succession, the number of sample points in the sample space is ————.
5. When all the values are equal, the standard deviation would be ————.

Write True *or* False :

6. Mutually exclusive events are independent.
7. If $F(x)$ be the cumulative distribution function of a random variable, then $0 \le F(x) \le 1$.
8. Mean lies between median and mode.
9. In a moderately asymmetrical distribution, the mean, median and mode are the same.
10. Correlation coefficient is independent of change of origin and scale.

(10 × 1 = 10 marks)

Turn over

Section B

Answer **all** *questions in* **one sentence** *each.*
Each question carries 2 *marks.*

11. Define primary data.
12. Give the normal equations for fitting the straight line $y = a + bx$.
13. What do you mean by probability mass function ?
14. Define random experiment with an example.
15. How will you compute mode for a frequency distribution ?
16. Define Population.
17. How can the two regression lines be identified ?

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*
Each question carries 4 *marks.*

18. The ranks of the same 10 students in two subjects A and B are given below :

    (3, 6), (5, 4), (8, 9), (4, 8), (7, 1), (10, 2), (2, 3), (1, 10), (6, 5) and (9, 7). Find the rank correlation coefficient.

19. Fit a straight line of the form $y = ax + b$ to the following data :

x	:	1	3	5	7	8	10
y	:	8	12	15	17	18	20

20. Explain the desirable properties of a good average.
21. Prove that for any discrete distribution, standard deviation is not less than mean deviation from the mean.
22. A discrete random variable has the following probability distribution :

X	:	0	1	2	3	4	5	6	7	8
$p(x)$	:	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$

Find (i) the value of a ; and (ii) P (X < 3).

(3 × 4 = 12 marks)

Section D

Answer any **four** *questions.*
Each question carries 6 *marks.*

23. From the following information obtain the correlation coefficient :

$$n = 12, \sum x = 30, \sum y = 5, \sum x^2 = 670, \sum y^2 = 285, \sum xy = 334.$$

24. Define coefficient of variation. Compute the same for the observations 7, 9, 10, 8, 6 and 5.

25. A man travels 600 km. by train at an average speed of 60 km/h. 300 km. by boat at an average speed of 15 km./h, 700 km. by plane at 350 km./h and 25 km. by a taxi at 50 km./h. Find the average speed of the whole journey.

26. If $p(x) = (0.1)\,x$; $x = 1, 2, 3, 4$. Find (i) $P[X = 1 \text{ or } 2]$; and (ii) $P\left[\frac{1}{2} < X < \frac{5}{2} \mid X > 1\right]$.

27. Two random variables X and Y have the following joint probability density function :

$$f(x, y) = \begin{cases} 2 - x - y; & 0 \le x \le 1, \quad 0 \le y \le 1 \\ 0; & \text{otherwise.} \end{cases}$$

Find (i) marginal density functions of X and Y ; and (ii) conditional density functions.

28. Define pairwise independence and mutual independence of events. Discuss the implication between them.

(4 × 6 = 24 marks)

Section E

Answer any **two** *questions.*
Each question carries 10 *marks.*

29. The following table gives the marks obtained by some students. Calculate mean, median and mode :

Marks	:	0–10	10–20	20–30	30–40	40–50
Frequency	:	3	13	18	12	5

30. From the following data of values of X and Y, find the regression equation of Y on X :

X	:	2	3	4	5	6
Y	:	3	5	4	8	9

31. (a) Give the axiomatic definition of probability.

(b) A committee of four has to be formed from among 3 economists, 4 engineers, 2 statisticians and 1 doctor.

(i) What is the probability that each of the four professions is represented on the committee ?

(ii) What is the probability that the committee consists of the doctor and atleast one economist ?

32. State Baye's Theorem. A machine part is produced by three factories A, B and C. Their proportional production is 25, 35 and 40 per cent respectively. Also, the percentage defective manufactured by three factories are 5, 4 and 3 respectively. A part is taken at random and is found to be defective. Obtain the probability that the selected part belongs to factory B.

(2 × 10 = 20 marks)

D 12527 **(Pages : 4)** **Name.......................................**

Reg. No..................................

FIRST SEMESTER (CUCBCSS-UG) DEGREE EXAMINATION NOVEMBER 2021

Statistics

STS 1C 01—BASIC STATISTICS AND PROBABILITY

(2016—2018 Admissions)

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions in one word.*
Each question carries 1 *mark.*

Fill up the blanks :

1. A part of the population is known as ————.
2. The sum of the deviations from mean is always ————.
3. If $r = 0$, the two lines of regression are at an angle of ————.
4. If $B \subset A$, then probability of $\left(A \cap \bar{B}\right)$ is ————.
5. ———— can be calculated from a frequency distribution with open end classes.

Write true *or* false :

6. If mean and standard deviation of a distribution are 20 and 4 respectively, co-efficient of variation is 15%.
7. The geometric mean of a set of values lies between arithmetic mean and harmonic mean.
8. The value of multiple correlation co-efficient lies in between –1 and +1.
9. If A and B are two events which have no events in common, then the events A and B are independent.
10. For a continuous random variable X, P $(a < X < b) = F(b) - F(a)$, Where F(.) is the distribution function of X.

(10 × 1 = 10 marks)

Turn over

Section B

Answer **all** *questions in one sentence each.*
Each one carries 2 marks.

11. Define mode.

12. What do you mean by quartiles ?

13. If $r_{12} = 0.4$, $r_{23} = 0.5$ and $r_{13} = 0.6$, calculate multiple correlation co-efficient $R_{1.23}$.

14. Suppose A and B are any two events and $P(A) = p_1$, $P(B) = p_2$ and $P(A \cap B) = p_3$. Find $P\left(\bar{A} \cup B\right)$.

15. State the axiomatic definition of probability.

16. Let X be a random variable with pdf $f(x) = \begin{cases} ke^{-2x}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$, find the value of k.

17. Explain the term statistical regularity.

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*
Each question carries 4 marks.

18. The arithmetic mean of two observations is 127.5 and their GM is 60. Find : i) Harmonic mean and ; ii) The two observations.

19. State and prove addition theorem of probability.

20. Prove with an example that pairwise independence does not imply mutual independence.

21. Three newspapers A B and C are published in a city. It is estimated from a survey that of the adult population : 20% read A, 16% read B, 14% read C, 8% read both A and B, 5% read both A and C, 4% read both B and C, 2% read all three. Find what percentage read at least one of the papers ?

22. If X is a random variable with pmf $p(x) = pq^x$, $x = 0, 1, 2, \ldots 0 < p < 1$, $p + q = 1$, find the distribution of $Y = 2X$.

(3 × 4 = 12 marks)

Section D

Answer any **four** *questions.*
Each one carries 6 *marks.*

23. Compute quartile deviation and co-efficient of quartile deviation for the following data :

Variable	...	10	20	30	40	50	60
Frequency	...	4	7	15	8	7	2

24. Using the principle of least squares explain the procedure for fitting the curve $Y = ab^x$.

25. Calculate Karl Pearson's co-efficient of correlation for the following data :

X	...	6	8	12	15	18	20	24	38	31
Y	...	10	12	15	15	18	25	22	26	28

26. If $f(x) = \frac{x}{15}$, $x = 1, 2, 3, 4, 5$, find : i) P $\{x = 1 \text{ or } x = 2\}$ and ii) P $\{1/2 < X < 5/2 \mid X > 1\}$.

27. If A and B are independent events, show that : i) $\bar{A}$ and $\bar{B}$ are independent ; ii) $\bar{A}$ and B are independent iii) A and $\bar{B}$ are independent.

28. Let X be a continuous random variable with pdf $f(x) = e^{-x}, 0 < x < \infty$. Find the probability density function of : i) $Y = 2X + 5$; and ii) $Y = X^3$.

(4 × 6 = 24 marks)

Section E

Answer any **two** *questions.*
Each question carries 10 *marks.*

29. i) Define standard deviation.

ii) Calculate the co-efficient of variation of the following two series and find which series is more consistent.

Variable	...	10-20	20-30	30-40	40-50	50-60	60-70
Series A	...	10	18	32	40	22	18
Series B	...	18	22	40	32	18	10

Turn over

30. Obtain the equation of the line of regression of Y on X and X on Y. Show that the angle θ between the two lines of regression is given by $\tan\theta = \left(\frac{r^2 - 1}{r}\right)\frac{\sigma_x \sigma_y}{\sigma_x^2 \sigma_y^2}$ where r is the correlation co-efficient between X and Y.

31. i) State and prove Bayes theorem.

ii) The contents of urns I, II and II are as follows :

Urn I ... 1 white, 2 black and 3 red balls

Urn II ... 2 white, 1 black and 1 red balls

Urn III ... 4 white, 5 black and 3 red balls

One urn is chosen at random and two balls drawn from it. They happen to be white and red. What is the probability that they come from urns I, II or III ?

32. Let X be a continuous random variable with pdf $f(x) = 6x(1 - x), 0 \le x \le 1$.

i) Check that the above is a pdf.

ii) Obtain the distribution function of X,

iii) Compute $P\left(X \le \frac{1}{2} \mid \frac{1}{3} \le X \le \frac{2}{3}\right)$,

iv) Determine the number k such that $P(X < k) = P(X > k)$.

(2 × 10 = 20 marks)