National University of Computer & Emerging Sciences, Karachi
Spring-2017 CS-Department
Final Examination
May 12, 2017 (9:00am to 12:00pm)

Course Code: MT-206	Course Name: Probability & Statistics
Instructor Names :	M Jamil, M Ashhad, Abdul Basit, Imran Shah
Student Roll No:	Section No:

Instruction:

1. Answer all questions on answer script.

2. Read each question completely before answering it. There are 25 MCQ's and 4 pages.

Time: 30 minutes. Max Points : 25

Question 1: . . . . **25 points**

(a) A continuous variable can be described as:
   A. Able to take only certain discrete values within a range of scores
   B. Able to take any value within a range of scores
   C. Being made up of categories
   D. None of the above

(b) The standard deviation is equal to:
   A. The variance
   B. The square-root of the variance
   C. The variance squared
   D. The variance divided by the number of scores

(c) The mode is:
   A. The frequency of the most common score divided by the total number of scores
   B. The middle score after all the scores have been ranked
   C. The most frequently occurring score
   D. The sum of all the scores divided by the number of scores

(d) A normal distribution should have which of the following properties?
   A. Bell shaped
   B. Be symmetrical
   C. The tails of the distribution should meet the x-axis at infinity
   D. All of the above

(e) If you have a negatively skewed distribution then:
   A. The mean, median and mode are equal
   B. The right-hand tail is extended
   C. The left-hand tail is extended
   D. None of the above

(f) Given the following set of data (8, 7, 9, 12, 14, 10, 14, 11, 13, 14), what are the mean, median and mode?

      A. 11.2, 11.5, 14

      B. 112, 12, 14

      C. 10, 5, 14

      D. 10, 12, 14

(g) The degree of peakedness is called:

      A. Symmetry

      B. Skewness

      C. Dispersion

      D. Kurtosis

(h) What is the probability 1 in 5 expressed as a percentage?

      A. 14%

      B. 25%

      C. 20%

      D. 32%

(i) If an event has a probability of 95% of occurring, what does this mean?

      A. The event is likely to occur 5 times out of every 100

      B. The event is likely to occur 95 times out of every 100

      C. The event is likely to occur 95 times out of every 95

      D. None of the above

(j) If two variables are totally independent, then the correlation between them is:

      A. -0.1

      B. -1.00

      C. +1.00

      D. zero

(k) If $MSTR = 12.4$ and $MSE = 3.1$ in one-way ANOVA , what would your F-statistics be?

      A. 6.2

      B. 4.1

      C. 3.1

      D. 4

(l) Which of the following is not a condition of the binomial distribution?

      A. Only 2 possible outcomes

      B. have constant probability of success

      C. Must have at least 3 trials

      D. trials must be independent

(m) In a Poisson probability distribution:

      A. The mean and variance of the distribution are same (equal)

      B. The probability of success is always greater than 5

      C. The number of trials is always less than 5

      D. It always contains a contingency table

(n) In binomial distribution n=6 and p=0.9, then the value of P(X=7) is:
   A. one
   B. less than zero
   C. more than zero
   D. zero

(o) In which distribution successive trials are without replacement:
   A. Hypergeometric Distribution
   B. Binomial Distribution
   C. Poisson Distribution
   D. Geometric Distribution

(p) The probability of success changes from trial to trial in:
   A. Hypergeometric Distribution
   B. Binomial Distribution
   C. Poisson Distribution
   D. Geometric Distribution

(q) Hypergeometric distribution has parameters:
   A. 1
   B. 2
   C. 3
   D. 4

(r) A coefficient of correlation is computed to be -0.95 means that:
   A. The relationship between two variables is weak
   B. The relationship between two variables is strong and positive
   C. The relationship between two variables is strong and but negative
   D. Correlation coefficient cannot have this value

(s) If you roll a pair of dice, what is the probability that (at least) one of the dice is a 4 or the sum of the dice is 7?
   A. $\frac{4}{36}$
   B. $\frac{13}{36}$
   C. $\frac{21}{36}$
   D. $\frac{15}{36}$

(t) In descriptive statistics, we study:
   A. The description of decision making process
   B. The methods for organizing, displaying, and describing data
   C. How to describe the probability distribution
   D. None of the above

(u) The height of a student is 60 inches. This is an example of ......:
   A. Qualitative data
   B. Categorical data
   C. Continuous data
   D. Discrete data

(v) Which branch of statistics deals with the techniques that are used to organize, summarize, and present the data:

      A. Probability Statistics

      B. Inferential Statistics

      C. Descriptive Statistics

      D. Bayesian Statistics

(w) If X is a random variable, then E(2 - 3X) is

      A. E(3X)

      B. E(2) - E(3X)

      C. 2- 3E(X)

      D. 9 E(X)

(x) If X and Y are independent random variables then E(XY) is equal to

      A. E(X).E(Y)

      B. X. E(Y)

      C. E(X) . Y

      D. E(X) + E(Y)

(y) Total Area under the normal curve is

      A. 1

      B. 0

      C. Greater than 1

      D. Less than 1

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Instruction:

1. Answer all questions on answer script .
2. All the answers must be solved according to the sequence given in the question paper.
3. Read each question completely before answering it. There are 7 questions and 3 pages.
4. Show all your work. You will receive credit for a correct answer only if your work is shown and your work supports your answer.

Time: 150 minutes. Max Points : 75

Question 2: . . . . **10 points**

Corrosion of reinforcing steel is a serious problem in concrete structures located in environments affected by severe weather conditions. For this reason, researchers have been investigating the use of reinforcing bars made of composite material. One study was carried out to develop guidelines for bonding glass-fiber-reinforced plas tic rebars to concrete (Design Recommendations for Bond of GFRP Rebars to Concrete, J. of Structural Engr., 1996: 247254). Consider the following 48 observations on measured bond strength:

11.5	12.1	9.9	9.3	7.8	6.2	6.6	7.0	13.4	17.1	9.3	5.6
5.7	5.4	5.2	5.1	4.9	10.7	15.2	8.5	4.2	4.0	3.9	3.8
3.6	3.4	20.6	25.5	13.8	12.6	13.1	8.9	8.2	10.7	14.2	7.6
5.2	5.5	5.1	5.0	5.2	4.8	4.1	3.8	3.7	3.6	3.6	3.6

Use limit grouping with a first class of 2-4

(a) Find Quartiles from grouped data.

(b) Construct Box-Plot using part (i).

(c) Compute Variance using $s^2 = \sum \dfrac{f_i(x_i - \bar{x})^2}{n-1}$

Question 3: . . . . **5 points**

For married couples living in a certain suburb, the probability that the husband will vote on a bond referendum is 0.21, the probability that the wife will vote on the referendum is 0.28, and the probability that both the husband and the wife will vote is 0.15. What is the probability that

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(a) At least one member of a married couple will vote?

(b) A wife will vote, given that her husband will vote?

(c) A husband will vote, given that his wife will not vote?

Question 4: .... **10 points**

(a) From a box containing 4 black balls and 2 green balls, 3 balls are drawn in succession, each ball being replaced in the box before the next draw is made.

   i. Find the probability distribution for the number of green balls.

   ii. Find the cumulative probability distribution for the number of green balls.

   iii. Find expected value of number of green balls.

(b) Suppose that the error in the reaction temperature, in $°C$, for a controlled laboratory experiment is a continuous random variable X having the probability density function

$$f(x) = \begin{cases} \dfrac{x^2}{3} & , -1 < x < 2, \\ 0 & , \text{ elsewhere.} \end{cases}$$

Find $F(x)$, and use it to evaluate $P(0 < X \leq 1)$.

Question 5: .... **10 points**

(a) From a lot of 10 missiles, 4 are selected at random and fired. If the lot contains 3 defective missiles that will not fire, what is the probability that

   i. all 4 will fire?

   ii. at most 2 will not fire?

(b) The probabilities are $0.4, 0.2, 0.3$, and 0.1, respectively, that a delegate to a certain convention arrived by air, bus, automobile, or train. What is the probability that among 9 delegates randomly selected at this convention, 3 arrived by air, 3 arrived by bus, 1 arrived by automobile, and 2 arrived by train?

Question 6: .... **10 points**

(a) Given the normally distributed variable X with mean 18 and standard deviation 2.5, find

   i. $P(X < 15)$;

   ii. the value of k such that $P(X < k) = 0.2236$;

   iii. the value of k such that $P(X > k) = 0.1814$;

   iv. $P(17 < X < 21)$.

(b) A multiple-choice quiz has 200 questions, each with 4 possible answers of which only 1 is correct. What is the probability that sheer guesswork yields from 25 to 30 correct answers for the 80 of the 200 problems about which the student has no knowledge?

Question 7: ....15 points

(a) An experiment was conducted on a new model of a particular make of automobile to determine the stopping distance at various speeds. The following data were recorded.

Speed, v (km/hr)	35	50	65	80	95	110
Stopping Distance, d (m)	16	26	41	62	88	119

   i. Fit a quadratic regression curve of the form $\widehat{d} = a + bv + cv^2$.[Show all your work]

   ii. Estimate the stopping distance when the car is traveling at 70 kilometers per hour.

   iii. Use calculator to find relation between the above two variables and comments.

(b) The personnel department of a certain industrial firm used 10 subjects in a study to determine the relationship between job performance rating (y) and scores on two tests. The data are as follows:

y	11.2	14.5	17.2	17.8	19.3	24.5	21.2	16.9	14.8	20.0
x_1	56.5	59.5	69.2	74.5	81.2	88.0	78.2	69.0	58.1	80.5
x_2	71.0	72.5	76.0	79.5	84.0	86.2	80.5	72.0	68.0	85.0

Estimate the regression coefficients in the model $\widehat{y} = b_0 + b_1 x_1 + b_2 x_2$,

Question 8: ....**15 points**

In the article Using EDE, ANOVA and Regression to Optimize Some Microbiology Data (Journal of Statistics Education, Vol. 12, No. 2, online), N. Binnie analyzed bacteria-culture data collected by G. Cooper at the Auckland University of Technology. Five strains of cultured Staphylococcus aureusbacteria that cause staph infections were observed for 24 hours at 27C. The following table reports bacteria counts, in millions, for different cases from each of the five strains.

Strain A	Strain B	Strain C	Strain D	Strain E
9	3	10	14	33
27	32	47	18	43
22	37	50	17	28
30	45	52	29	59
16	12	26	20	31

(a) Verify one-way ANOVA identity [i.e., $SST = SSE + SSTR$]

(b) Construct a one-way ANOVA table.