MMS-I 21-12-2012

BM 01

Business Mathematics

Roll No. Total No. of Printed Pages: 8

Total No. of Questions : 7 Maximum Marks : 60

Duration (hrs.) :3 Hours

Section , if any : None

Note : (i) Q.1 is compulsory. It has two sub questions A & B each of 10 marks.

(ii) Solve any 4 out of Q.2 to Q.7.

(iii) Each of these six questions have 3 sub questions (a) (b) (c) of 5 marks each, solve any two of these three sub questions.

Q.1) **PART A**

Multiple choice questions: Each of the following 10 questions gave options. Write the correct answer ***(not just a, b, c etc)*** in the answer sheets. (1 Mark Each)

1. If there are 2 numerical questions related to 2 decision variables of a given study. One of them is a dependent variable while other is independent, the type of the test for analysis is:

   a. ANOVA I
   b. Z test
   c. Multiple Regression
   d. Chi Square

2. A sample of 25 women has been asked to give their opinion on the smoothness of their skin before and after using a moisturizing body lotion in the market. The women were given a "ten point rating scale" to judge the difference. The proper statistical test for examining the data is

   a. Regression analysis
   b. ANOVA
   c. t-test for 2 Dependent Samples
   d. Z-test

3. When respondents are asked to rank local shopping malls so that their first choice is 1, their second choice is 2, and so forth, this is best described as an example of _____ data

   a. Ordinal
   b. Ratio
   c. Interval
   d. Nominal

4. A consultant performed regression analysis for purchase factors for a laptop, where he found r = 0.6. The model is

   a. Weak b. Moderate c. Strong

5. The categorical (qualitative) graphical representation techniques are

   a. Bar Graph, Pie Charts etc
   b. Histogram, Frequency Polygon
   c. Both a and b
   d. None of the above

6. *"Suppose k samples of size "n" are drawn randomly from a population that has a mean of μ and a standard deviation of σ. Then sample means $\bar{x}_i$, follow normal distribution with* ***mean as μ*** *and* ***standard deviation as $\sigma/\sqrt{n}$*** *for sufficiently large sample sizes ($n \geq 30$). Even if the population does not follow normal distribution, the sample means are normally distributed for any size sample."*

   The above result is an outcome of which of the followings principles in statistics

   a. Chebeyshev's Lemma
   b. Central Limit Theorem
   c. Empirical Rule
   d. Baye's Theorem

7. The only measure of central tendency that can be used on a nominal data is

   a. Mean
   b. Median
   c. Mode
   d. S.D.

8, 9 & 10) A consumer group would like to estimate the mean monthly electricity charge for a single family house in July within error margin of $5 using a 95 percent level of confidence for which the Z value to be taken is 1.96. Based on similar studies the standard deviation is estimated to be $20.00. Calculate the approximate sample size required for the study.

Note: This question is for 3 marks and No marks will be given if calculations are not shown

   a. 107
   b. 61

c. 200

d. 154

Q.1) PART B

For the following two cases (1) State the null and alternative hypothesis, (2) State the test to be used for a particular case. (3) State the decision as to accept or reject Ho (4)State your decision and (5) State the business Implication

i) A sample of 87 professional working women showed that the average amount paid annually into a private pension fund per person was $3352. The population standard deviation is $1100. A sample of 76 professional working men showed that the average amount paid annually into a private pension fund per person was $5727, with a population standard deviation of $1700.

A women's activist group wants to "prove" that women do not pay as much per year as men into private pension funds.

They have used α= 0.0001 and the given sample data and have arrived at following results.

Calculated value of test statistic = -10.42 p-value = 0.00000000000000000001

Will they be able to reject a null hypothesis that women annually pay the same as or more than men into private pension funds? Use the hypothesis-testing process.

ii) Based on an indication that mean daily car rental rates may be higher for Boston than for Dallas, a survey of eight car rental companies in Boston is taken and the sample mean car rental rate is $47, with a standard deviation of $3. Further, suppose a survey of nine car rental companies in Dallas results in a sample mean of $44 and a standard deviation of $3.

An appropriate hypothesis testing was done and following results were obtained.

p-value = 0.028

Can it be concluded that the average daily car rental rates in Boston are significantly higher than those in Dallas. Assume car rental rates are normally distributed and the population variances are equal.

Q.2.a) A purchasing agent obtained samples of 60 watt bulbs from two companies. He had the samples tested in his own laboratory for the length of life with the following results

Length of Life (in hours)	Samples from	
	Company A (F1)	Company B (F2)
17 – 19	10	3
19 – 21	16	40
21 – 23	20	12
23 – 25	8	3
25 – 27	6	2

$\sum F1*X = 1288$; $\sum F2*X = 1242$; $\sum F1*X^2 = 27984$; $\sum F2*X^2 = 25860$

(i) Calculate S.D. for Company A & B (4 M)
(ii) Based on the above results, which would you choose A or B and Why. (1 M)

Q.2.b) Using the data given below: (Total 5 marks)

Wages per week	50-100	100-150	150-200	200-250	250-300	300-350	350-400	400-450	450-500
No. of Workers	15	35	40	40	125	100	70	20	15

Draw Box plot using three quartiles (5 M)

Q.2.c) The rise in the price of a certain commodity was 5% in 1995, 8% in 1996 and 77% in 1997. It is said that the average price rise between 1995 and 1997 was 26% and not 30%. Justify the statement and show how you would explain it before a layman. (5M)

Q.3.a) In a bolt factory, machines A, B and C manufacture 25 percent, 35 percent and 40 percent of total output. Of their total output 5, 4, and 2 percent are defective bolts. A

bolt is selected at random and is found defective. What is the probability that it was manufactured by machines? (Use Bayes Theorem) (5 M)

(i) Machine A

(ii) Machine B

Q.3.b) Following is the data pertaining to the 30 Major League Baseball teams for the last season. Following cross tabulation shows the classification of teams having a winning season Vis a Vis the attendance these teams enjoyed for the respective matches played by them.

	Attendance (in Millions)			
Wins	≤ 1.5	1.5 to 2.5	> 2.5	Grand Total
Not Winning	6	7	3	16
Winning	2	5	7	14
Grand Total	8	12	10	30

If a team is selected at random what is the probability that,

a) Has a losing season or an attendance of more than 2.5 million

b) Having a winning season and drawing less than 1.5 million attendances.

Q.3.c) According to Nielsen Media Research, approximately 67% of all U.S. households with television have cable TV. Seventy-four percent of all U.S. households with television have two or more TV sets. Suppose 55% of all U.S. households with television have cable TV and two or more TV sets. A U.S. household with television is randomly selected.

a) What is the probability that the household has cable TV or two or more TV sets?

b) What is the probability that the household has cable TV or two or more TV sets but not both?

Q.4.a) Assume baggage is rarely lost by Northwest Airlines. Suppose a random sample of 1,000 flights shows a total of 300 bags were lost. Thus, the arithmetic mean number of lost bags per flight is 0.3 (300/1,000). If the number of lost bags per flight follows a Poisson distribution with m= 0.3,

a) What is the probability that no bags will be lost on a particular flight.

b) What is the probability exactly one bag will be lost on a particular flight?

Q.4.b) The probability that a student is accepted to a prestigious college is 0.3. If 5 students apply to the same prestigious college, using binomial distribution

(i) What is the probability that at most 2 are accepted?

(ii) What is the probability that at least 2 are accepted?

Q.4.c) The lifetime of certain kinds of electronic devices have a mean of 300 hours and S.D. of 25 hrs. Assuming normal distribution, what is the probability that the devices will have the lifetime of

(i) more than 350 hours
(ii) less than 300 hours

Q.5) Answer any two of the following
a. Explain the sampling procedure and various sampling techniques
b. Explain characteristics of normal distribution
c. Explain characteristics of binomial and Poisson distribution

Q.6.a) As per the past experience the individuals filling the income tax return followed normal distribution with an average refund of Rs.1200 and S.D. as Rs.1600. A study was done of the individuals who file their return in the last week of June, and for a sample of 400 individuals it was found that the average refund amount was Rs.1054. Using 5% percent level of significance test the claim whether that the refund value for the individuals filling their income tax returns in the last week of June was less than the early income tax return fillers.

Q.6.b) A national youth organization sells six different kinds of cookies during its annual cookie campaign. A local leader is curious about whether national sales of the six kinds of cookies are uniformly distributed. He randomly selects the amounts of each kind of cookies sold from five outlets and combines them into the observed data that follow.

The uniformly distributed means that all the kinds of cookies are sold equally. So the expected frequency is to be taken equal to the average of all observations for each kind of cookie.

Kind of Cookie	Observed frequency
Chocolate Chips	189
Peanut Butter	168
Cheese cracker	155
Lemon Flavored	161
Chocolate mint	216
Vanilla Filled	165
Total	1054

Use a = .05 to determine whether the data indicate that sales for these six kinds of cookies are uniformly distributed. (If critical value for $\chi 2 = 11.07$)

Q.6.c) Suppose prior elections in a certain state indicated it is necessary for a candidate for governor to receive at least 80 percent of the vote in the northern section of the state to be elected. The incumbent governor is interested in assessing his chances of returning to office and plans to conduct a survey of 2,000,registered voters in the northern section of the state, out of which 1550 gave affirmative response. Using the hypothesis-testing procedure for proportion,. assess the governor's chances of reelection at 0.01 L.O.S.

Q.7) ***Solve any one of the following*** (10 M each)

Q.7) a) The following data pertains to the test scores and productivity index of 10 workers in a factory.

(10 M)

Aptitude test (X) :	60 62 65 70 72 48 53 73 65 82
Productivity Index (Y) :	68 60 62 80 85 40 52 62 60 81

$\sum X^2 = 43144$; $\sum Y^2 = 44002$; $\sum XY = 43294$

Calculate:

(a) Two regression equations and then find

(b) The productivity index of a worker with test score as 92

OR

Q.7) b) Some people drink coffee to relieve stress on the job. Is there a correlation between the number of cups of coffee consumed on the job and perceived job stress?

Suppose the data shown represent the number of cups of coffee consumed per week and a stress rating for the job on a scale of 0 to 100 for nine managers in the same industry.

Cups of Coffee per week	25	41	16	0	11	28	34	18	5
Job Stress	80	85	35	45	30	50	65	40	20

Calculate:

(a) Two regression equations and then find

(b) If a person drinks 30 cups of coffee per week, predict the stress level