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SARDAR PATEL UNIVERSITY
B.Sc. Semester – IV Examination
Wednesday , 13th April, 2016
US04ESTA04
(Biostatistics – II)

No. Of Printed Pages: 3

Time: 10.30 to 12.30 p.m

M.Marks: 70

Note: (*i*) Statistical table will be allowed/provided on request (*ii*) Simple/Scientific calculator is allowed.
(*iii*) Q.3 to 6 each sub questions have 5 marks.

Q.1 Multiple Choice Questions (10 × 1)

(1) Which of the following are characteristics of Normal distribution?
(a) Symmetric   (b) Mean = Median = Mode   (c) Bell shaped   (d) All of these

(2) The regression equation of X on Y is $X = -0.54Y + 1.75$ then
(a) $b_{XY} = 1.75$ (b) $b_{XY} = 0.54$ (c) $b_{YX} = +1.75$ (d) $b_{XY} = -0.54$

(3) A study found a correlation of $r = -0.84$ between the sex of a worker and his or her income. You conclude that:
(a) Women earn more than men on average.
(b) Women earn less than men on average.
(c) An arithmetic mistake was made; this is not a possible value of r.
(d) This is nonsense because r makes no sense here.

(4) The degrees of freedom in t - test for testing difference of two population means is
(a) $n+1$ (b) $n-1$ (c) $n_1 + n_2 + 2$ (d) $n_1 + n_2 - 2$

(5) What does a coefficient of correlation 0.7 mean?
(a) Almost no correlation because 0.7 is close to 1
(b) 49% of the variation in one variable is explained by the other variable
(c) Coefficient of determination is 0.49
(d) Both (b) and (c)

(6) When the researcher rejects a true null hypothesis, a _____ error occurs.
(a) Type - A   (b) Type - B   (c) Type - I   (d) Type - II

(7) When using the chi square test for independence of two attributes with a contingency table that has r rows and c columns, how many degrees of freedom will the test statistic have?
(a) $n-1$ (b) $n_1 + n_2 - 2$ (c) $(r-1) + (c-1)$ (d) $(r-1)(c-1)$

(8) The regression lines of X on Y and Y on X
(a) Do not intersect   (b) Intersect at any point   (c) Intersect at $(\overline{X}, \overline{Y})$ (d) None of these

(9) For testing of hypothesis about population mean , we use:
(a) Z − test   (b) t − test   (c) F- test   (d) Both Z & t − test

(10) Given a Normal distribution with $\mu = 100$ and $\sigma = 10$, what is the probability that $X > 75$?
(a) 0.9938   (b) 0.2512   (c) 0.4943   (d) 0.4522

Q.2 Short Type Questions (Attempt Any Ten) (10 × 2)

(1) The vitamin content of a particular brand of vitamin supplement pill is normally distributed with mean 490 mg and s.d. 12 mg. What is the probability that a randomly selected pill contains at least 500 mg of vitamin?

(2) Write down the regression equation which could be used to predict the value of X for any given value of Y, mention clearly, the formula for calculating each term in the required equation.

(3) State the conditions under which paired t – test is used.

(4) Give two examples each of:
(*i*) Positive correlation (*ii*) Negative correlation (*iii*) Spurious (Non-sense) correlation.

(5) Write in brief on chi square test in a 2×2 contingency table.

(6) List out the various methods of studying relationship between two quantitative variables. Write in brief about any one of them.

(7) Given that Z is a standard normal variate evaluate and sketch for $P(-1.62 \leq Z \leq 1.32)$

(8) State the nature of the following correlations:
(*i*) Age of applicant for life insurance and the premium of insurance
(*ii*) The colour of sari and the intelligence of the lady who wears it.

(9) Which of the following is continuous probability distribution?
   (a)Binomial   (b)Poisson   (c)Normal   (d)All of the above
   Choose an appropriate option and write down any three properties of it.

(10) With reference to testing of hypothesis, define the following:
   (a) Null hypothesis   (b) Type – I error

(11) The measurement of the length of the index finger of a human right hand is a normally distributed variable with a mean of 6 cm. and a standard deviation of 0.5 cm. What is the probability that the finger length of a randomly selected person will be between 4.3 cm. and 6.5 cm?

(12) Two types of drugs were tested in 5 and 7 patients for reducing their weights. The decrease in the weight after using the drugs for six months was recorded as given below:

Drug - A	11	13	12	14	10	
Drug - B	12	9	8	15	9	10

In order to test whether there is a significant difference in the efficiency of the two drugs, which statistical test would you recommend? Write down null and alternative hypotheses for the same.

Q.3(a) An experiment is carried out at different temperatures dissolving 100 gm of salt in 100 ml of water. The results are as under.

Temperature(^{0}C)	0	10	20	30	40	50	60	70
Weight of salt(gm)	88.0	83.5	82.2	73.5	72.6	67.2	61.5	51.5

(i) Identify an independent and dependent variable (ii) Calculate coefficient of determination and comment on it.

(b) The Body Weight (BW) and Resting Metabolic Rate (RMR) of 10 patients who admitted in the hospital are given below:

Body weight(kg)	57.6	64.9	59.2	60.0	72.8	77.1	82.0	86.2	91.6	99.8
RMR(kcal/24 hrs)	1325	1365	1342	1316	1382	1439	1536	1466	1519	1639

(i) Is there any relationship between these two variables? Justify your answer by calculating most suitable statistical measure. Comment on your findings (ii) Predict the RMR of a patient whose body weight is 70kg.

OR

Q.3(a) Juhi's parents recorded his height at various ages up to 84 months. Below is a record of the results:

Age (months)	36	48	60	72	84
Height (in Inches)	35	38	41	43	45

(i)Identify an independent and dependent variable (ii) At what age Juhi's height will be 55 inch?

(b) When water flows across farm land, some of the soil is washed away, resulting in erosion. An experiment was conducted to investigate the effect of the rate of water flow on the amount of soil washed away. Flow is measured in liters per second and the eroded soil is measured in kilograms. The data are given in the following table.

Flow rate	0.31	0.85	1.26	2.47	3.75
Eroded Soil	0.82	1.95	2.18	3.01	6.07

(i) Identify an independent and dependent variable (ii) Is there any relationship between them? Justify your answer by calculating suitable statistical measure and comment on it.

Q.4(a) Given that Z is a standard normal variable, Sketch each one and evaluate the following probabilities.
   (i)$P(Z \le -2.02)$ (ii) $P(Z \le 1.87)$ (iii) $P(Z \ge -2.06)$ (iv) $P(-1.32 \le Z \le 1.76)$

(b) The distribution of weights for the population of males is normally distributed with $\mu = 172.2$ pounds and s.d $\sigma = 29.8$ pounds. What is the probability that a randomly selected man weigh (i) less than 130 (ii) more than 210 (iii) between 130 to 210, pounds?

OR

Q.4(a) Find the area under the standard normal curve for the following, using the z - table. Sketch each one.
   (i) between $z = 0$ and $z = +0.78$ (ii) between $z = -0.56$ and $z = -0.32$
   (iii) to the right of $z = 0.78$ (iv) to the left of $z = -1.33$

(b) In a survey administered on 2000 students the average height of student is 156 cms with standard deviation of 3 cms. How many students have height (i) less than 150 cms (ii) greater than 162 cms (iii) between 153 and 162 cms? (Assume that the height of students are normally distributed)

Q.5(a) To determine the possible effect of a chemical treatment on the rate of seed germination, 100 chemically treated seeds and 150 untreated seeds are sown. The number of seeds that germinated is recorded. Is the

treatment effective? Test at $\alpha = 0.05$.

Types of seed	Germinated	Not germinated	Total
Treated	84	16	100
Untreated	132	18	150
Total	216	34	250

(b) The table below compares the levels of carboxyhemoglobin for a group of smokers and a group of cigarette non - smokers. Sample means and standard deviations are shown.

Group	Sample size	Carboxyhemoglobin (%)	
		Mean	Standard Deviation
Smokers	75	4.1	2.0
Non - smokers	121	1.3	1.3

Is carboxyhemoglobin levels of smokers and non - smokers be same, on average? Test at $\alpha = 0.05$.

OR

Q.5(a) Among the 144 individuals who had experience myocardial infraction (Heart attack), 46 were diagnosed with diabetes; among 144 individuals who were free of heart disease, only 25 suffered from diabetes.

Is there any association between diabetes and occurrence of myocardial infraction?

(b) A new method of skin complaint is to be tested against a standard treatment. The success rate of the standard treatment is known to be 50%. Of an r.s of 100 subjects given the new treatment, 60 responded successfully. Is the new treatment better than standard treatment?

Q.6(a) An experiment is conducted to determine if the use of a special chemical additive with standard fertilizer accelerates plant growth. Ten locations are included in the study. At each location, two plants growing in close proximity are treated; one is given the standard fertilizer; the other is given the standard fertilizer with the chemical additive. Plant growth after four weeks is measured in centimeters, and the following data are obtained:

	Location									
	1	2	3	4	5	6	7	8	9	10
Without additive	20	31	16	22	19	32	25	18	20	19
With additive	23	34	15	21	22	31	29	20	24	23

Do the data substantiate the claim that use of chemical additive accelerates plant growth?

(b) Two types of drugs were used in 5 and 7 patients for reducing their weights. The decrease in the weight after using the drugs for six months was recorded as given below:

Drug - A	11	13	12	14	10	
Drug - B	12	9	8	15	9	10

Is there significant difference in the efficiency of the two drugs? Test at $\alpha = 0.05$.

OR

Q.6(a) Two groups of guinea pigs each were injected, respectively with 1.0 mg and 1.5 mg of a new tranquillzer and the following are the number of minutes it took to fall asleep:

1.0 mg	19	21	20	18	22	20
1.5 mg	15	10	13	14	11	

Test the null hypothesis that, difference in dosage has no effect.

(b) A physician wants to compare the blood pressures of six patients before and after treatment with a drug. The blood pressures are as follows:

Patient	1	2	3	4	5	6
Before Drug	168	171	182	167	174	170
After Drug	171	170	180	173	178	172

The physician wants to test if there is a significant change of the blood pressure before and after taking the drug at 0.05 level of significance. Carry out an appropriate test. What do you conclude?

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