Sardar Patel University

M.Sc. (Bioscience) – $1^{st}/2^{nd}$ Semester Examinations

Time: 10.30 to 1.30 p.m.  Wednesday, $29^{th}$ April, 2015  M.Marks:70

Biostatistics

(PS01EBBIC01/PS01EMIC01/ PS01EBIT02 )

Note:
($i$) Simple/Scientific calculator is allowed.  ($ii$) Figures to the right indicate marks.
($iii$) Statistical table will be allowed/provided on request  ($iv$) Q.3 to Q.6, each sub-question has 6 marks.

Q.1  Multiple choice Questions  (8×1)
(1)  Which of the following can be described as a variable?
   (a) Heart rate     (b) Body temperature     (c) Pulse rate     (d) All of these
(2)  Consider the following probability distribution:
$$P(x) = \binom{10}{x} (0.3)^x (0.7)^{10-x}, x = 0,1,\dots,10$$
   The standard deviation of $X$ is
   (a) 2.1     (b) 0.21     (c) 1.45     (d) None of these
(3)  Which of the following is an inexpensive method to draw random sample from the population?
   (a) Lottery method     (b) Use of Random numbers table
   (c) Both (a) and (b)     (d) None of these
(4)  The degrees of freedom for 3 × 3 contingency table is
   (a) 5     (b) 4     (c) 3     (d) 7
(5)  In the regression equation $Y = 3X + 2$, what does the 2 represent?
   (a) Slope of the line     (b) $Y$ intercept
   (c) Any value of the independent variable that is selected   (d) None of the above
(6)  The alternative hypothesis for a one tailed test can be of the form:
   (a) $\mu =$     (b) $\mu \neq$     (c) $\mu < or \mu >$     (d) All of the above
(7)  The main aim of sample survey is to get reliable information about the _____ in less time
   and at a lower cost.
   (a) Sample     (b) Population     (c) Both (a) and (b)     (d) Neither (a) nor (b)
(8)  A group of 10 men were given a special diet for two weeks to test weight loss in pounds. The
   observed data was:

| Man | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Weight before | 181 | 171 | 190 | 187 | 210 | 202 | 166 | 173 | 183 | 184 |
| Weight after | 178 | 172 | 185 | 184 | 201 | 201 | 160 | 168 | 180 | 179 |

   To determine if the data provide sufficient evidence to indicate the special diet leads to a weight loss,
   the appropriate test procedure is :
   (a) two sample unpaired t - test     (b) paired t - test
   (c) both (a) and (b)     (d) None of these

Q.2  Short Answer Type Questions **(Attempt Any Seven)**  (7×2)
(1)  What is Scatter plot (diagram)? Write down its limitations.
(2)  State the importance of diagrams.
(3)  List out the various methods of drawing a random sample. If the population is large which method do
   you adopt? Why?
(4)  Let $X \sim b\left(6, \frac{1}{3}\right)$. Find its ($i$) mean and standard deviation ($ii$) $P(X \leq 4)$
(5)  Write down the regression equation which could be used to predict the value of $Y$ for any given value
   of $X$. Write down the formula for each term in the equation.
(6)  Given that $Z$ is a standard normal variate, Sketch each one and evaluate the following probabilities.

(i) $P(Z \le -2)$ (ii) $P(Z \ge 1.78)$

(7) A sample of underweight babies was fed a special diet and the following weight gains (lbs) were observed at the end of three month.

| 6.7 | 2.7 | 2.5 | 3.6 | 3.4 | 4.1 | 4.8 | 5.9 | 8.3 |

Calculate mean and standard deviation.

(8) Write in brief about Simple Random Sampling (SRS).

(9) List out the various measures of central tendency. Define any one of them with its merits and demerits.

Q.3(a) Write a note on Stratified Random Sampling.

(b) Present the following information through a most suitable diagram. State its objective(s).

Country wise diabetic patients

| Country | Year | |
|---------|------|------|
| | 2007 | 2015* |
| India | 40.9 | 69.9 |
| China | 39.8 | 59.3 |
| USA | 19.2 | 25.4 |
| Russia | 9.6 | 10.3 |

* Projected or estimated ** figures in million.

OR

Q.3(a) Give three examples each of
(i) Nominal and Ordinal data (ii) Variable and Attribute, useful in Bioscience.

(b) A study was conducted to comparing female adolescent who suffer from bulimia to healthy females with similar body composition and levels of physical activity. Listed below are measures of daily caloric intake, recorded in kilocalories per kg, for samples of adolescents from each group.
(i) Find the median daily caloric intake for both the bulimic adolescents and the healthy ones.
(ii) Which group has a greater amount of variability in the measurement?

| Daily Caloric Intake(Kcal/Kg) | | | |
|------|------|------|------|
| Bulimic | | Healthy | |
| 15.9 | 18.9 | 20.7 | 30.6 |
| 16 | 19.6 | 22.4 | 33.2 |
| 16.5 | 21.5 | 23.1 | 33.7 |
| 17 | 21.6 | 23.8 | 36.6 |
| 17.6 | 22.9 | 24.5 | 37.1 |
| 18.1 | 23.6 | 25.3 | 38.4 |
| 18.4 | 24.1 | 25.7 | 40.8 |

Q.4(a) Define correlation. State the different types of correlations. Give two examples of each.

(b) Following table gives age and vital capacity for each of 12 workers in the cadmium industry.

| Age | 39 | 40 | 41 | 41 | 45 | 49 | 52 | 47 | 61 | 65 | 58 | 59 |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|
| Vital Capacity | 4.62 | 5.29 | 5.52 | 3.71 | 4.02 | 5.09 | 2.70 | 4.31 | 2.70 | 3.03 | 2.73 | 3.67 |

Calculate (i) the correlation coefficient and comment on it (ii) Predict the vital capacity of a worker whose age is 42 years.

OR

Q.4(a) What is regression? State its uses. Write down the properties of regression coefficients.

(b) Hardik's parents recorded his height at various ages up to 84 months.

| Age(months) | 36 | 48 | 60 | 72 | 84 |
|---|---|---|---|---|---|
| Height(inches) | 35 | 38 | 41 | 43 | 45 |

(i) Compute $r$, the Pearson correlation coefficient and comment on it (ii) Predict the height at the age of 8 years.

Q.5(a) It was claimed that 1 out of 3 dentists who recommend Sensodyne tooth paste for sensitivity of teeth to his/her patients. Suppose that the claim is true. If 10 dentists are selected independently and at random. Let $X$ be the no. of dentists who recommend sensodyne tooth paste to his/her patients.
(i) How is $X$ distributed? (ii) Give the mean and standard deviation of $X$ (iii) Determine $P(X \geq 3)$.

(b) 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 (i) between 5 cm. and 7.5 cm (ii) more than 4.5 cm (iii) less than 5.3 cm.

OR

Q.5(a) It is known that 10% of plants produced by a certain species of corn seed will be infertile. In a random sample of 5 such plants, what is the prob. that (i) exactly 1 (ii) 2 or less (iii) more than 3, will be infertile?

(b) Measurements of the acidity level (pH) of rain samples were recorded at 12 sites in an industrial region.

| 4.3 | 4.2 | 4.5 | 4.9 | 4.7 | 4.8 |
|---|---|---|---|---|---|
| 3.5 | 5.1 | 5.0 | 3.6 | 4.8 | 3.6 |

Is the mean acidity level (pH) of rainy water is same as normal water level i.e. 7? Test at 5% level of significance.

Q.6(a) Given that $Z$ is a standard normal variable, Sketch each one and evaluate the following probabilities.
(i) $P(Z \leq -2)$ (ii) $P(Z \leq 1.78)$ (iii) $P(Z \geq -1.22)$ (iv) $P(-1.62 \leq Z \leq 1.62)$

(b) Two diets were to be compared. Seventy five individuals were selected at random from a population of overweight people. Forty of this group were assigned to diet A and the remaining thirty five were placed on diet B. The weight losses in pounds over a period of one week were found and the following information was recorded.

| | Sample size | Sample mean(lbs) | Sample variance |
|---|---|---|---|
| Diet - A | 40 | 10.3 | 7.00 |
| Diet - B | 35 | 7.3 | 3.25 |

Is Diet – A is better than diet – B? Test at $\alpha = 0.05$.

OR

Q.6(a) A study is conducted to determine whether the use of electronic fetal monitoring during labor affects the frequency of caesarian section deliveries. Caesarian delivery can be thought of as "disease" and electronic monitoring as the "exposure". Of the 5824 included in the study, 2850 were electronically monitored during labor and 2974 were not. The outcomes are as follows:

| | EFM exposure | |
|---|---|---|
| Caesarian delivery | Yes | No |
| Yes | 358 | 229 |
| No | 2492 | 2745 |

Is there any association between the use of electronic fetal monitoring and the eventual method of delivery?

(b) Two types of drugs were used in 5 patients each 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 |

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

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