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## [4169]-311

T.Y. B.Com. EXAMINATION, 2012

## BUSINESS STATISTICS

## Paper II

(2008 PATTERN)
Time : Three Hours
Maximum Marks : 80
N.B. :- (i) All questions are compulsory.
(ii) Figures to the right indicate full marks.
(iii) Use of calculator and statistical tables is allowed.
(iv) Symbols and abbreviations have their usual meanings.

1. (A) Attempt any four of the following :
(a) Give any two real life situations where Poisson distribution can be used.
(b) If a random variable X follows binomial distribution with mean 4 and variance 2.4, find the values of the parameters $n$ and $p$.
(c) If A and B are any two independent events with $P(A \cup B)=0.8$ and $P(B)=0.5$, find $P(A)$.
(d) Find the value of :

$$
{ }^{10} \mathrm{C}_{8}+{ }^{5} \mathrm{P}_{5}
$$

(e) Define the term Economic Order Quantity (EOQ) used in inventory control.
(f) State whether each of the statements given below is True $\boldsymbol{r}$ False :
(i) If X and Y are two independent discrete random variable (DRV) then :

$$
\operatorname{Var}(\mathrm{X}-\mathrm{Y})=\operatorname{Var}(\mathrm{X})-\operatorname{Var}(\mathrm{Y}) .
$$

(ii) The value of probability cannot be negative.
(B) Attempt any two of the following :
(a) Given $\mathrm{P}(\mathrm{A})=0.6, \mathrm{P}(\mathrm{B})=0.7$ and $\mathrm{P}(\mathrm{A} \cup \mathrm{B})=0.9$, find :
(i) $\mathrm{P}\left(\mathrm{B}^{\prime}\right)$
(ii) $\mathrm{P}(\mathrm{A} \cap \mathrm{B})$
(iii) $\mathrm{P}(\mathrm{B} / \mathrm{A})$.
(b) A hospital switch board receives on an average 4 emergency calls in 10 minutes interval. Using Poisson distribution find probability that :
(i) there is no call in an interval of 10 minutes ?
(ii) there are at most 3 calls in an interval of 10 minutes?
(c) A dealer supplies the following information with respect to a product :

Annual demand : 10,000 units
Ordering cost : Rs. 10 per order
Price per unit : Rs. 20
Inventory carrying cost : $20 \%$
Back order cost : $25 \%$
Determine :
(i) The optimal order quantity.
(ii) The optimal back order quantity.
(iii) Total variable cost.
2. Attempt any two of the following :
[8 each]
(a) Explain the following terms giving one illustration :
(i) Mutually exclusive events
(ii) Probability of an event
(iii) Discrete random variable
(iv) Probability distribution.
(b) (i) X is a discrete random variable with probability mass function (p.m.f.)

$$
\begin{aligned}
\mathrm{P}[\mathrm{X}=x] & =\frac{x}{15} ; \quad x=1,2,3,4,5 \\
& =0 \quad ; \quad \text { otherwise }
\end{aligned}
$$

Find $\mathrm{E}(\mathrm{X})$ and $\operatorname{Var}(\mathrm{X})$
(ii) If $\mathrm{X} \rightarrow \mathrm{N}(2,4)$ and $\mathrm{T}=3 \mathrm{X}+9$, find $\mathrm{E}(\mathrm{T})$ and $\operatorname{Var}(\mathrm{T})$.
(c) The joint probability distribution of ( $\mathrm{X}, \mathrm{Y}$ ) is given by :

| $\mathbf{Y} \mathbf{X}$ | $\mathbf{- 1}$ | $\mathbf{0}$ | $\mathbf{+ 1}$ |
| :---: | :---: | :---: | :---: |
| 2 | K | 2 K | 2 K |
| 3 | 3 K | 3 K | 4 K |
| 4 | 2 K | 2 K | K |

Obtain :
(i) The value of K
(ii) Marginal probability distribution of X and Y
(iii) Conditional probability distribution of Y given $\mathrm{X}=0$ (iv) $\operatorname{Var}(\mathrm{X})$.
3. Attempt any two of the following :
[8 each]
(a) (i) State advantages of sample survey over census survey.
(ii) Write a short note on 'systematic sampling'.
(b) Fill in the blanks of the following ANOVA tables marked " - " :

| Source of <br> variation | Degrees of <br> Freedom | Sum of <br> Squares | Mean sum <br> of squares | Variance <br> ratio |
| :--- | :---: | :---: | :---: | :---: |
| Between Machines | 4 | 100 | - | - |
| Between Workers | - | - | 40 | - |
| Error | 12 | 120 | - |  |
| Total | - | - |  |  |

Test the homogeneity of machine types and workers at $1 \%$ level of significance (l.o.s.).
(c) (I) Daily wages of 1,000 workers in a factory are normally distributed with mean wage Rs. 150 and standard deviation (S.D.) 15. Estimate the number of workers having daily wages :
(i) between Rs. 140 and Rs. 160
(ii) more than Rs. 150.
(II) Explain the following terms used in testing of hypothesis :
(i) Null hypothesis
(ii) Level of significance
(iii) Test statistic
(iv) Type II error.
4. Attempt any two of the following :
[8 each]
(a) (i) An oil exploration firm finds that $5 \%$ of the test wells it drills, yield a deposit of natural gas. If it drills 6 wells, find the probability that at least one well will yield natural gas.
(ii) A machine produces 16 detectives in a sample of 500 articles. After overhauling, it produced 3 defectives in a batch of 100. Is there any significant difference in the performance due to overhauling ? Use $5 \%$ level of significance.
(b) (i) In a hypothetical population the values of units are 7, $13,15,17$ and 20 . Write all possible samples of size 2 by using the method of Simple Random Sampling Without Replacement (SRSWOR) from this population and examine whether the sample mean is an unbiased estimator of population mean.
(ii) A computer operator claims that she can type at the rate of 100 words per minute on an average. In 10 trials, she typed at an average rate of 116 words with a standard deviation of 15 words. Can we accept her claim at $5 \%$ level of significance (l.o.s.).
(c) (i) Explain in brief $\chi^{2}$ test of independence of two attributes for $2 \times 2$ contingency table.
(ii) Two random samples are drawn from two normal populations and the following information is obtained :

| Sample | Sample | Sum of Sample | Sum of squares |
| :---: | :---: | :---: | :---: |
| No. | Size | observations | of sample <br> observations |
| I | 9 | 9.6 | 61.52 |
| II | 11 | 16.5 | 73.26 |

Test whether the two populations have equal variances. Use 5\% level of significance.
5. Attempt any two of the following :
(a) In survey on the area under a crop, 186 villages in a district was divided into 4 strata. The area under the crop in selected villages was noted. The following is the information about survey :

| Stratum | Stratum | Sample | Area under the crop in the |
| :---: | :---: | :---: | :--- |
| No. | Size | Size | villages selected in sample |
| $\left(\mathbf{N}_{\boldsymbol{i}}\right)$ | $\left(\boldsymbol{n}_{\boldsymbol{i}}\right)$ |  |  |
| 1 | 72 | 8 | $14,12,8,11,12,10,13,16$ |
| 2 | 53 | 5 | $27,20,21,22,30$ |
| 3 | 35 | 4 | $36,46,52,61$ |
| 4 | 26 | 3 | $92,105,82$ |

Obtain estimate of :
(i) each population stratum mean
(ii) population mean
(iii) population total.
(b) A certain machine is supposed to produce red, yellow and green candy wrappers in the ratio 4 : 3 : 2 . In a sample of 90 wrappers produced by the machine were observed to be 31 red, 38 yellow and 21 green. Is the machine working properly ? (Use 5\% level of significance).
(c) The following are the weekly losses of work hours due to accidents in industrial plants before and after a certain safety program was put into operation :

| Plant No. | Before | After |
| ---: | :---: | :---: |
| 1 | 45 | 36 |


| 2 | 73 | 60 |
| :---: | :---: | :---: |
| 3 | 46 | 44 |
| 4 | 124 | 119 |

$5 \quad 33 \quad 35$
$6 \quad 57 \quad 51$

$10 \quad 17$

Test whether the safety program was effective. (Use 5\% level of significance).

