Date:

Day: M T W T F S S

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Subjeet: Probability & Statistic

Dept: Computer science

AssignmentNo: sessional (1)

University:- Iqra national university
peshawer.

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Q1

Part-(a)

Solution:-

we know that

$$\text{Mean} = np$$

$$4 = np$$

$$p = \frac{4}{n} \rightarrow (1)$$

Also we know that

$$\text{Variane} = np(1-p)$$

$$9 = n(4/n)(1-4/n)$$

$$9 = 4\left(1-\frac{4}{n}\right)$$

$$9 = 4-\frac{16}{n}$$

$$\frac{16}{n} = 4-9$$

$$\frac{16}{n} = -5$$

$$-5n = 16$$

$$\boxed{n = \frac{-16}{5}}$$

put in eq$_n$ (1)

$$p = \frac{4}{-16/5} = \frac{-20}{16}$$

$$\boxed{p = \frac{-5}{4}}$$

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Part -(b) (Q1)

Critical Region:-

The set of outcomes of a statistical test for which the null hypothesis is to be rejected is called critical region.

Part - (c) (Q1)

Properties of t-distribution:-

- The t- distribution ranges from $-\infty$ to $+\infty$ (infinity).
- The variance is always greater than one and can be defined only when the degrees of freedom $v \geq 3$ & is given as

$$Var(t) = \frac{v}{v-2}$$

- The t- distribution has greater variability than the standard normal distribution.
- Standard normal distribution the shape of t-distribution is also bell-shaped & symmetrical with mean zero.

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Part - (d) (Q1)

Analysis of variances:-

Analysis of variance (ANOVA) is an analysis tool used in statistics that splits an observed aggregate variability found inside a data set into two parts: Systematic factors and random factors. The systematic factors have a statistical influence on the given data set, while the random factors do not, Analysts use the ANOVA test to determine the influence that independent variables have on the dependent variable in a regression study.

Ans-(e) (Q1)

R.B.D :-

=> It is Randomized Block Design

=> In a randomized block design there is only one primary factor under Consideration in the experiment.

=> Similar test subjects are grouped into blocks.

=> Each block is tested against all treatment levels & the primary factor at random order.

Part-(f) (Q1)

Statistical Quality Control :-

Statistical quality control refers to the use of Statistical methods in the monitoring and maintaining of the quality of products and services. SQC use different tools to analyze quality problem.

1) Descriptive statistics.
2) Statistical process control (SPC)
3) Acceptance Sampling.

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Part-(g) (Q1)

Chance Cause:-

A process that is operating with only chance causes of variation present is said to be in statistical control. In other words, the chance causes are an inherent part of the process.

Assignable Cause:-

Assignable cause is an identifiable, specific cause of variation in a given process (or) measurement. A cause of variation that is not random and does not occur by chance is assignable.

Part-(h) (Q1)

Traffic Intensity:-

It is defined as;

"The ratio of the time during which a facility is cumulatively occupied to the time this facility is available for occupancy."

The traffic intensity is

$$\frac{aL}{R}$$

Part-(1) (Or)

Characteristics of Queuing Theory:-

* From the set of Customer waiting for service, do we choose the one to be served next. e.g FIFO (first-in first-out) also known as FCFS (first-come first served); LIFO (Last-in first out)

=) Do we have:

=) Balking (Customers deciding not to join the queue if it is too long).

=) Reneging (Customers leave the queue if they have waited too long for service)

=) Jockeying (Customers switch between queues if they think they will get served faster by so doing).

- A queue of finite capacity (or) of infinite capacity.

-: Q2 :-

part-(a)

The probability function for a binomial random variable is;

$$b(x;n,p) = \binom{n}{x} p^x (1-p)^{n-x}$$

if x is random variable with this probability distribution.

$$E(x) = \sum_{x=0}^{n} x \binom{n}{x} p^x (1-p)^{n-x}$$

$$= \sum_{x=0}^{n} x \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x}$$

$$= \sum_{n=1}^{n} \frac{n!}{(x-1)!(n-x)!} p^x (1-p)^{n-x}$$

let $y = x-1$ and $m = n-1$

$n = y+1$ and $n = m+1$

$$E(x) = \sum_{y=0}^{m} \frac{(m+1)!}{y!(m-y)!} p^{y+1} (1-p)^{m-y}$$

$$= (m+1)p \sum_{y=0}^{m} \frac{m!}{y!(m-y)!} p^y (1-p)^{m-y}$$

$$= np \sum_{y=0}^{m} \frac{m!}{y!(m-y)!} p^y (1-p)^{m-y}$$

Binomial therom says that

$$(a+b)^m = \sum_{y=0}^{m} \frac{m!}{y!(m-y)!} a^y b^{m-y}$$

Setting $a = p$ and $b = 1-p$

$$\sum_{y=0}^{m} \frac{m!}{y!(m-y)!} p^y (1-p)^{m-y} = \sum_{y=0}^{m} \frac{m!}{y!(m-y)!} a^y b^{m-y}$$

$$= (a+b)^m = (p+1-p)^m = 1$$

So that

$$\boxed{E(x) = np}$$

Similarly, but this time using $y = x-2$ and $m = n-2$

$$E(x(x-1)) = \sum_{n=0}^{n} n(n-1) \binom{n}{x} p^x (1-p)^{n-x}$$

$$= \sum_{n=0}^{n} x(x-1) \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x}$$

$$= \sum_{x=2}^{n} \frac{n!}{(x-2)!(n-x)!} p^x (1-p)^{n-x}$$

$$= n(n-1)p^2 \sum_{x=2}^{n} \frac{(n-2)!}{(x-2)!(n-x)!} p^{x-2} (1-p)^{n-x}$$

$$= n(n-1)p^2 \sum_{y=0}^{m} \frac{m!}{y!(m-y)!} p^y (1-p)^{m-y}$$

$$= n(n-1)p^2 (p + (1-p))^m$$

$$= n(n-1)p^2$$

So the variance of x is

$$E(x^2) - E(x)^2 = E(x(x-1)) + E(x)$$

$$E(x)^2 = n(n-1)p^2 + np - (np)^2$$

$$= (np)^2 - np^2 + np - (np)^2$$

$$= np - np^2 \quad \boxed{np(1-p)}$$

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Part-(b) - Q2:-

Let x denote number of cars hired out per day.

poisson distribution mean = $\mu = 1.5$

$$P(x=2) = \frac{e^{-\mu}\mu^2}{2!} = \frac{(e^{-1.5})(1.5)^2}{2!}$$

i) P(neither car is used):

$$P(x=0) = \frac{(e^{-1.5})(1.5)^0}{0!} = e^{-1.5}$$

$$P(x=0) = 0.2231$$

Proportion of days on which neither car is used

0.2231 = 22.31 %

ii) P(some demand is refused),

P (Demand is more then 2 cars per days).

$$P(z>2) = 1-P(z \le 2)$$

$$= 1 - [P(z=0) + P(z=1) + P(z=2)]$$

$$= 1 - [(e^{-1.5})(1.5)^0/0! + ((e^{-1.5})(1.5)^1/1!) + ((e^{-1.5})(1.5)^2/2!)]$$

$$= 1 - e^{-1.5}[1 + 1.5 + (2.25/2)]$$

$$= 1 - e^{-1.5}(1 + 1.5 + 1.125)$$

$$= 1 - e^{-1.5}(3.625) \Rightarrow 1 - 0.8087$$

0.1912

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Proportion of days on which some demand is refused = 0.1912

= 19.12 %

-: Q3 :-

(Suitable Chart)