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Department: BE(E)

Subject: Probability and statistics

Semester: 8

Teacher : Sir Daud

Probability and Statistics

Sessional Assignment Spring 2020

Marks : 20

1 Answer the following: (10 X 02 = 20 Marks)

(a) Mean and variance of binomial distribution is 4 and . Find n and p.

(b) If X is normally distributed with mean 12 and standard deviation 4 then find the probability if

(c) Define critical region.

(d) Write the properties of t-distribution.

(e) Write a short note on analysis of variance.

(f) Define R.B.D.

(g) Define statistical quality control.

(h) Define the terms "chance causes and assignable causes".

(i) Define traffic intensity.

(j) Write the characteristics of queuing theory.

2.

(a) Derive mean and variance of binomial distribution.

(b) A car hire firm has two cars, which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with mean 1.5. Calculate the proportion of days on which:
(i) Neither car is used. (ii) The proportion of days on which some demand is refused?

3. A set of 5 assembles of 15 sub-groups.

Group No.	No. of defects	Group No.	No. of defects
1	75	9	47
2	64	10	77
3	75	11	59
4	45	12	57
5	93	13	84
6	55	14	40
7	49	15	95
8	65	-	-

Draw a suitable chart and give your comment

Question No 1

Part (A)

Answer

Solution :-

As we know that

Mean $(np) = 4 \rightarrow$ (i) Variance $(npq) \rightarrow$ (2)

Dividing the LHS and RHS of equation (ii) by equation (i) we have

Npq/np

$= \frac{3}{4}$

Therefore,

we have $p = 1 - q = 1 - 3/4 = 1/4$

Putting the value of $p = 1/4$ in equation (i).

We have $\boxed{n = 16}$

Ans

Question NO 1

Part (B)

Answer

Solution:

Given:

Mean = 12

standard deviation = 4

Find:

Probability :- ?

Solution :-

$$Mean = \mu = np = 12 \rightarrow (1$$

$$SD = \sigma = \sqrt{npq} = 4 \rightarrow (2$$

Dividing ① & ②

$$\frac{\mu}{\sigma} = \frac{np}{\sqrt{npq}} = \frac{12}{4} = 3$$

$$\frac{np}{\sqrt{npq}} = 3$$

Seqvuaring both sides

$$\frac{(np)^2}{npq} = (3)^2$$

$$\frac{n^{\cancel{2}} p^{\cancel{2}}}{\cancel{np}q} = 9$$

$$\boxed{np = 9}$$

Now $np = 12$ —(1)

subtracting (3) and (1)

$$-np = 9q$$
$$\oplus np = \oplus 12$$
$$0 = 9q - 12$$

$$9q - 12 = 0$$
$$q = \frac{\cancel{12}\,4}{\cancel{9}\,3}$$

$$q = \frac{4}{3} > 1$$

The statement is incorrect as q can never be greater than 1.

Ans

Question No 1

Part (C)

Answer

Ans: **Critical Region:-**
A critical region, also known as the rejection region, is a set of values for the test statistic for which the null hypothesis is rejected. i.e. if the observed test statistic is in the critical region then we reject the null hypothesis and accept the alternative hypothesis.

Answer

Question No 1

Part (D)

Answer

Ans **Properties of T-distribution:-**

1) The t-distribution is equal to 0.
2) The variance is equal to $v/(v-2)$ where v is the degree of freedom (see last section) and $v > 2$

3) The Variance is always greater than 1, although it is close to 1 when there are many degree of freedom.

Ans//

Question No 1

Part (E)

Answer

Analysis of Variance:-

Analysis of variance, or ANOVA, is a statistical method that separates observed variance data into different components to use for additional tests. A one-way (ANOVA) is used for three or more groups of data, to gain information about the relationship between the dependent and independent variables.

Ans

Question No 1

Part (F)

Answer

Define R.B.D:-

RBD. A diagram that gives the relationship between component states and the success or failure of a specified system function. The logical layout in an RBD can be as series system, parallel system or a combination.

Ans

Question No 1

Part (G)

Answer

Statistical Quality Control:-

Statistical quality control the use of statistical methods in the monitoring and maintaining of quality of products and services. One method, referred to as acceptance sampling can be used when a decision must be made to accept or reject a group of parts or items based on the quality found in a sample.

Ans

Question No 1

Part (H)

Answer

1) Chance cause:- A process that is operating with only chance causes of variation present is said to be in statistical control.

2) Assignable Cause:- Is a type of variation in which a specific

activity or event can be linked to inconsistency in a system.

Question No 1

Part (I)

Answer

Traffic Intensity:-

A measure of the average accupancy of a facility during a specified period of time normally a busy hour, measured in traffic units (erlangs) and defined as the ratio of the time during which a facility is occupied (continuously or comulatively) to the time this facility is available for occupancy.

Question No 1

Part (J)

Answer

Characteristics of Queuing Theory:-

A queuing system is specified completely by the following five basic characteristics
The Input process. It expresses the mode of arrival of customers

at the service facility governed by some probability law. The number of customers emanate from finite or infinite sources.

Question No 2

Part (A)

Answer

Solution :-

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

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

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

Since the $x=0$ term vanishes

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

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

into the last sum (and using the fact that the ~~time~~ limits $x = 1$

and $x = n$ correspond to $y = 0$ and $y = n-1 = m$, respectively).

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

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

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

The binomial theorm 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 $m = n-2$

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

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

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

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

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

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

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

So the Variance of X is

$$E(x)^2 - E(X)^2 = E(X(X-1)) + E(X) - E(X)^2 = n(n-1)p^2 + np - (np)^2 = \boxed{np(1-p)}$$

Ans

Question No 2

Part (B)

Answer

Solution :-

Let x denote number of cars hired out per day

=> Poisson distribution mean = m = 1.5

=> P(X = x) = (((e^-m) (m^x))/(x!)) = (((e^-1.5) (1.5^x))/(x!))

1) P (neither car is used):

P (X=0) = (e^-1.5) (1.5^0)/0.2231

2) P (some demand is refused):

⇒ P (Demand is more than 2 cars per days) P(X>2)

⇒ 1- P (X ≤ 2)

⇒ 1- [P(x=0)+ P(x=1)+ P(x=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)] = 0.1912

⇒ Proportion of days on which neither car is used = 0.2231 = **22.31 %**

⇒ Proportion of days on which some demand is refused = 0.1912 = **19.12 %**

Ans

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Question No 3

A set of 5 assembles of 15 sub groups

Solution :-

Range : (40 – 93)

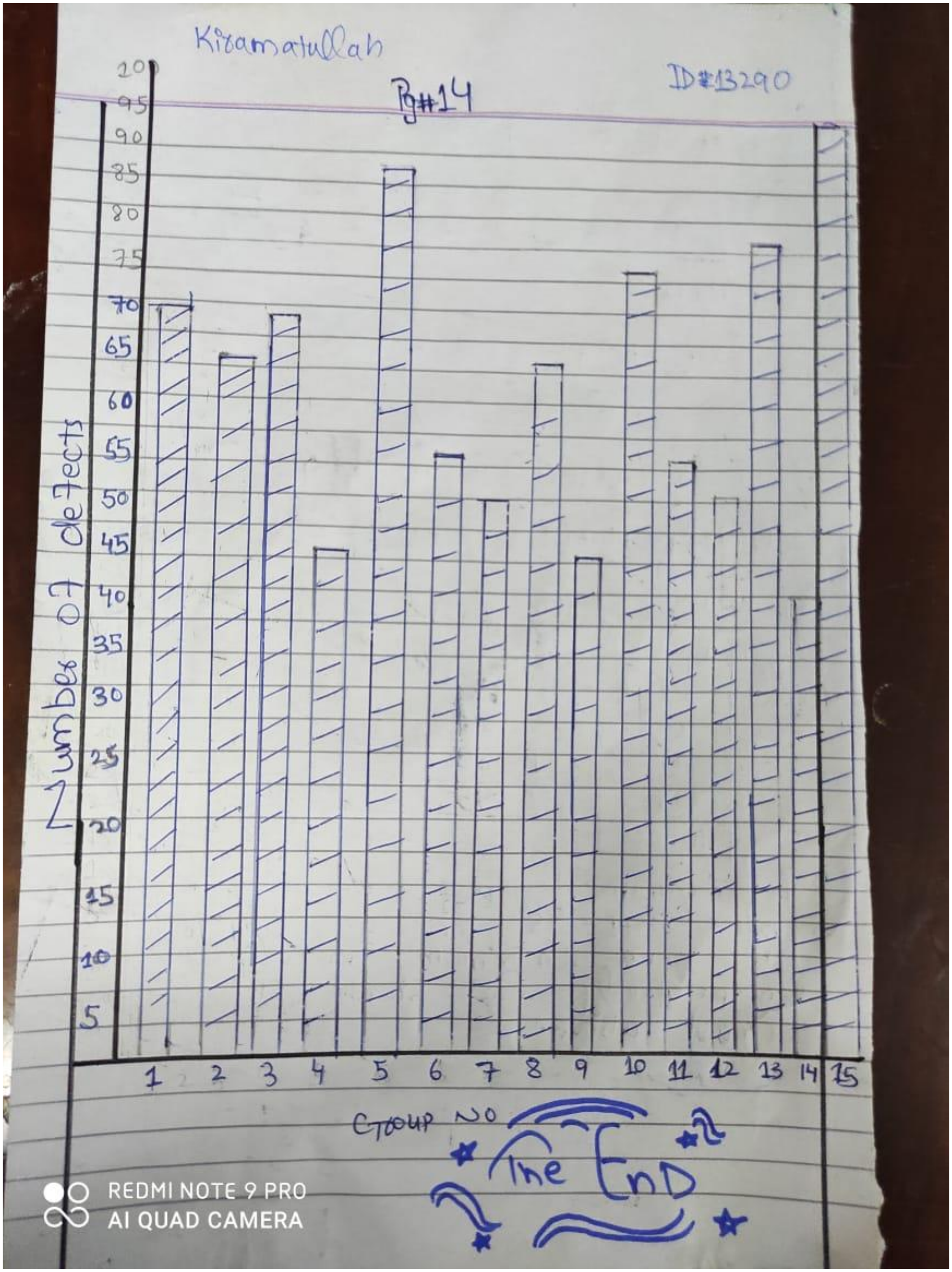
smallest value = 40

largest value = 95

For 5 assembles chart is given

Group	Range of Defects	Freavuency
1	40 – 50	4
2	51 – 60	3
3	61 – 70	2
4	71 – 80	3
5	81 – 95	3

The maximum freavuency has defects b/w 71 – 95. The group 4 and 5 have maximum no of defects respestively as shown in chart above.


Kiramatullah
Pg#14
ID#13290
Number of defects
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Group No
The End
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