① 15066

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Subject : Probability and Statistics

Dep : BS (CS)

Assignment : Sessional Assignment

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Q1

Ans(a) Solution :

We know that

$$\text{mean} = np$$

$$4 = np$$

$$p = \frac{4}{n} \longrightarrow ①$$

Also we know that

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

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

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

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

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

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

$$-5n = 16$$

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

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Put in eq 1

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

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

Hence $n = \frac{-16}{5}$ and $p = \frac{-5}{4}$

Ans (b) Critical Region:

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

Ans (c) properties of distributions:-

* like, standard normal distribution the shape of t-distribution is also bell-shaped and symetrical with mean zero.
* Th t-distribution ranges from $-\infty$ to $+\infty$ (infinity)

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* The variance is always greater than one and can be defined only when the degrace of freedom $v \geq 3$ and is given as.

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

* The t-distribution has greater variability than the standard distribution.

(Ans) (d)

Analysis of Variance:

Analysis of variance (ANOVA) is an analysis too used in Statistics that Splits an Observed aggregate variability found inside a data Set into two parts systomatic factors have Statictical influence on the given data Set. While the random factors do not Analysis use the (ANOVA) test to a determine the influence that

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independent variable have on the dependent variable in a regression Study.

Ans (e)

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 Subject are grouped into blocks.
- Each block is tested against all treatment levels of the primary factor at random order.

Ans (f)

Statistical Quality Control:

Statistical quality Control refers to the use of Statistical methods in the monitoring

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of the quanty of products and Services.

SQC uses different tools to analyze quality problem.

① Descriptive Statistics.
② Statistical process Control (SPC)
③ Acceptance Sampling.

Ans (g)

Chance Cause:-

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

Assignable Cause:

Assignable Cause is an identification specific cause of that is not random and does not occusy by chance is assignable.

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(Ans (h))

Traffic intensity:

It is defined as;

" The ratio of the time during which a facility is Cumulatively occupied to the time this facility is avaiblable for accupancy

The traffic intensity is:

$$\frac{\Delta L}{R}$$

Ans (i)

Characteristics of Queuing theory:-

* from the Set of custmers waiting for Service. do we Chose the the one to be Served next

e.g FIFO to be Served next e.g (first -in first - out) also know as FCFS (first - come first served); LIFO (last -in first out)

* Do we have

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- Balking (Customers deciding not to join the queue if it is too long.
- Renging (Customers leave the queue if They have waited too long for Serives.
- A queue of finite Capacity or ~~of~~ infinite Capacity.

Q2:-

Ans (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.

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

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

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

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

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

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

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

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

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

Binomial Theorem Says that

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

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

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

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

So that

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

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

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and $m = n-2$

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

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

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

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

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

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

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

So the variance of x is

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

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

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

$$= np - np^2$$

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

Ans (b)

Let X denote number of cars

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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.

$$0.2231 = \boxed{22.31\%}$$

(ii) p(Some demand is refused.

p(Demand is more then 2 Cars per days)

$$p(Z>2) = 1 - p(Z \le 2)$$

$$= 1 - [p(Z=0) + p(Z=1) + p(Z=2)$$

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

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

$$= 1 - e^{-1.5}(1 + 1.5 + 1.25)$$

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

$$= 1 - .08087$$

$$\boxed{= 0.1912}$$

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proportion of days on which some demand is refused

$= 0.1912$

$= \boxed{19.12\%}$

Q3 (Ans)

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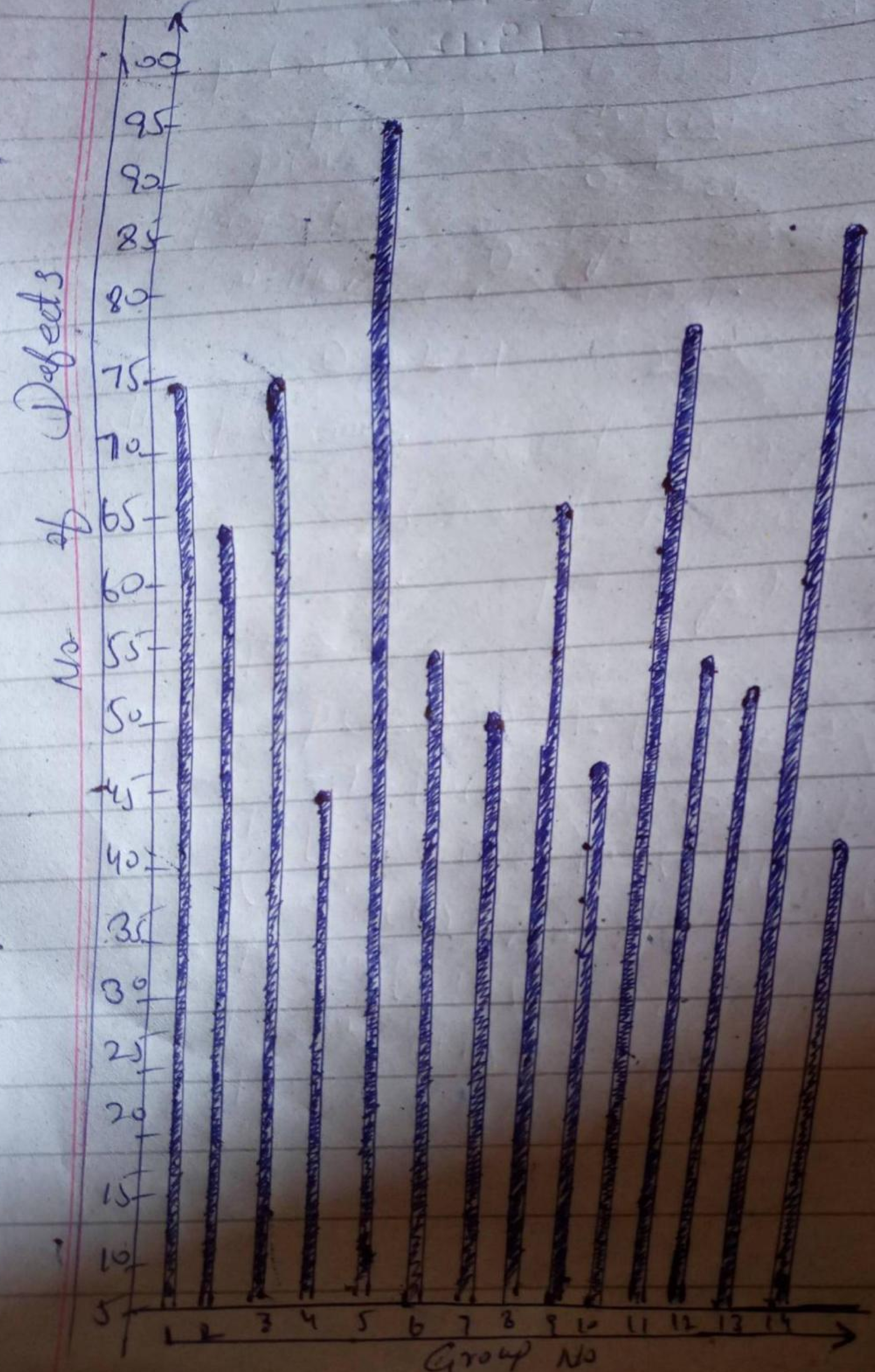
Q3
Suitable chart :-



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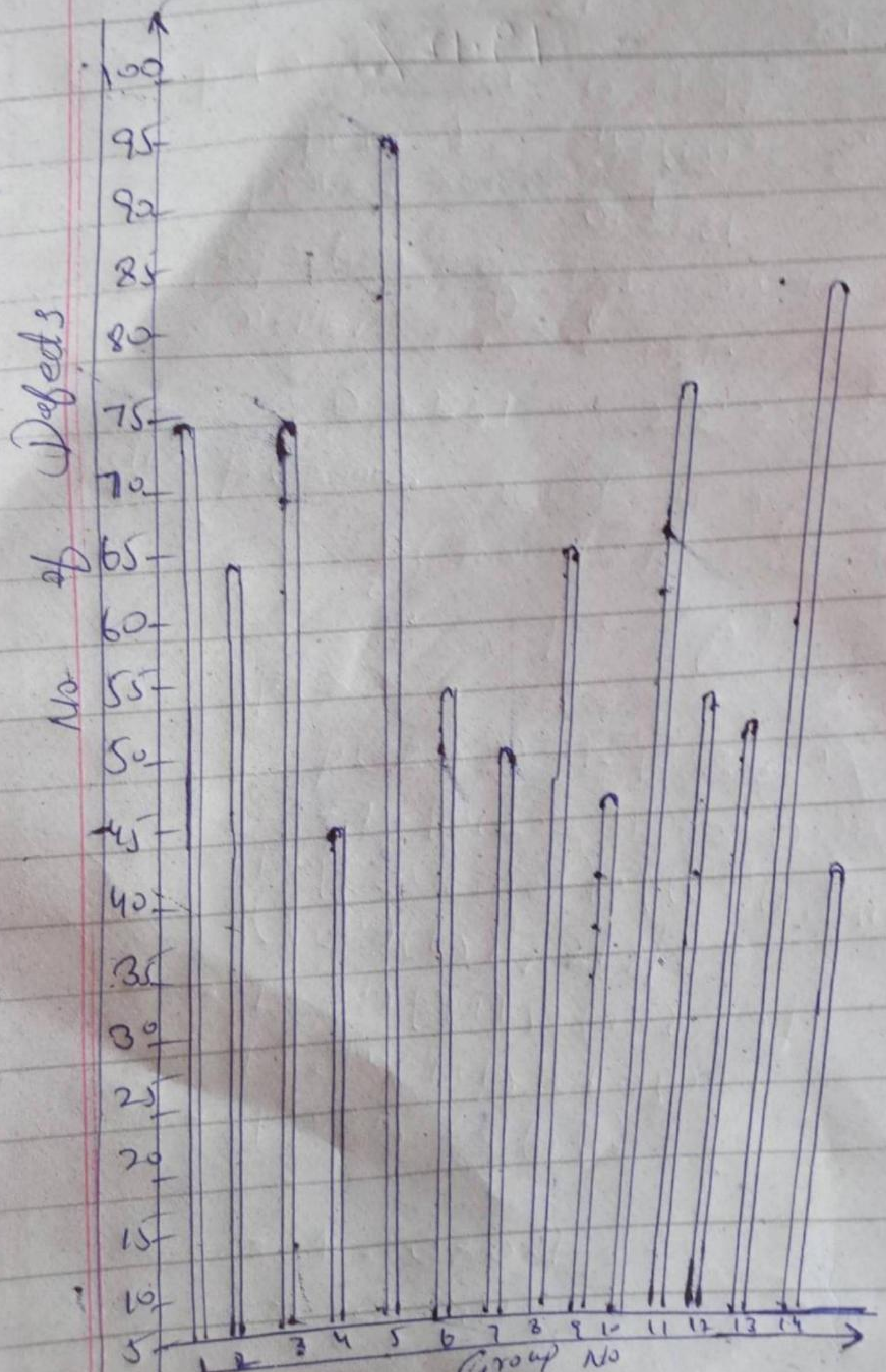
Q3
Suitable chart :-



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