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★ Properties of Measurement :
→ Identity : having unique meaning
→ Magnitude :-
→ Equal interval.
→ A minimum value of zero :

1. Nominal Scale of Measurement :- (labels)
→ does not have any numerical meaning
→ can't be divided, multiplied, added or substracted
– Used in research surveys and questionnaires
→ Most fundamental research scale.
★ Nominal with order : cold, warm, hot
★ Nominal without order : male and female
★ Dichotomous : having only two categories "Yes or No"

2. Ordinal scale of - - : - :
→ used to depict frequency, happiness, satisfaction
→ an ordered series of relationships or rank orders
→ can't be added to or substract.

3. Interval scale of measurment:
→ can be added or substracted but not ÷ or *
→ zero is an existing variable.
→ Used to quantify the difference between variables
→ Temperature and Time

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* Ratio scale of M -
-> Nominal, can be classified in order, contains intervals and can be broken down into exact values
-> Hieght, weight, distance.

* Central tendency : statistical measure
- single value of entire data
- Measures of central location
- summary statistics

* Mean
sample mean : $\bar{x} = \frac{\Sigma x}{n}$

Population mean : $\mu = \frac{\Sigma x}{N}$

x	0	1	2	3	4
f	3	6	6	3	1

$\mu = \frac{\Sigma f_i x_i}{\Sigma f_i}$

$\mu = \frac{0+6+12+9+4}{19}$

$= \frac{31}{19}$

$= 1.6316$

Skewed

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★ Median

★ Problem 1 :

$\bar{x} = \frac{\Sigma x_i}{n} = \frac{21+23+23+54+67+21+25+21+54+72+75}{11}$

$= \frac{456}{11}$

$= 41.45$

$\tilde{x}$

21, 21, 21, 23, 23, 25, 54, 54, 67, 72, 75

Here $n = 11$

$\therefore \left(\frac{n+1}{2}\right)^{th}$ observation will be median

$\tilde{x} = 25$

Mode - 21.

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Measures of variability of dispersion

similar values → little variability

- Range
- Variance
- Standard deviation

40, 38, 42, 40, 39, 39, 43, 40, 39, 40 (Set I)

$\bar{x} = \frac{\Sigma x_i}{n} = \frac{400}{10} = 40$

For $\tilde{x}$ = 38, 39, 39, 39, 40, 40, 40, 40, 42, 43

$\tilde{x} = 40$

Mode = 40

46, 37, 40, 33, 42, 36, 40, 47, 34, 45

$\bar{x} = 40$, $\tilde{x} = 40$, Mode = 40

Range

$R = x_{max} - x_{min}$

$= 43 - 38 = 5$ For Set I

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★ The variance and Standard Deviation

sample

$$s^2 = \frac{\Sigma (x-\bar{x})^2}{n-1}$$

$$s^2 = \frac{\Sigma x^2 - \frac{1}{n} (\Sigma x)^2}{n-1}$$

Sample S.D.

$$s = \sqrt{\frac{\Sigma (x-\bar{x})^2}{n-1}} = \sqrt{\frac{\Sigma x^2 - \frac{1}{n} (\Sigma x)^2}{n-1}}$$

Population

$$\sigma^2 = \frac{\Sigma (x-\mu)^2}{N} \quad \text{and} \quad \sigma = \sqrt{\frac{\Sigma (x-\mu)^2}{N}}$$

Set (7)

$$s^2 = \frac{(40-40)^2 + (38-40)^2 + (42-40)^2 + (40-40)^2 + \dots + (40-40)^2}{9}$$

$$s^2 = \frac{0 + 4 + 4 + 0 + 1 + 1 + 9 + 0 + 1 + 0}{9}$$

$$s^2 = \frac{20}{9} = \cancel{1.49} \; 2.22$$

$s = 1.49$

Set 2. $s^2 = \frac{36 + 9 + 0 + 49 + 4 + 16 + 0 + 49 + 36 + 25}{9}$

$s^2 = 24.889$

$s = 4.99$

☆ Stem and Leaf Diagrams

86	80	25	77	73	76	100	90	69	93
90	83	70	73	73	70	90	83	71	95
40	58	68	69	100	78	87	97	92	74

2	5
3	
4	0
5	8
6	9 8 9
7	7 3 6 0 3 3 0 1 8 4
8	6 0 3 3 7
9	0 3 0 0 5 7 2
10	0 0

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Ordered stem - leaf

2	5
3	
4	0
5	8
6	8 9 9
7	0 0 1 3 3 3 4 6 7 8
8	0 3 3 7 8
9	0 0 0 2 3 5 7
10	0 0

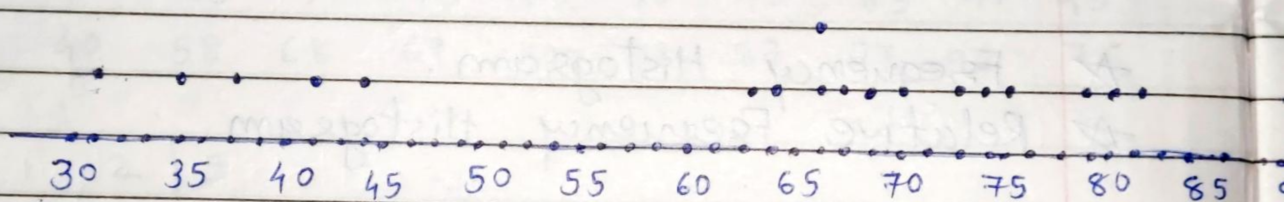
☆ Frequency Histogram.
☆ Relative Frequency Histogram.

20s	0.033
30s	0
40s	0.033
50s	~~0.1~~ 0.033
60	0.1
70	0.333
80	0.1666
90	0.2333
100	0.0666

★ Dotplots for Numerical Data

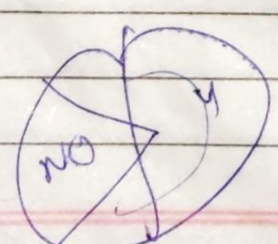
64, 41, 44, 31, 37, 73, 72, 68, 35, 37, 81, 90, 82, 74,
79, 67, 66, 66, 70, 63

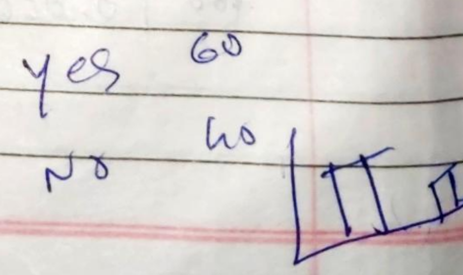
67, 21, 32, 88. 35, 71, 39, 35, 71, 63, 12, 46, 35, 39, 28,
65, 25, 24, 22



★ Bar chart :
when :- categorical data

★ Pie charts :
slices of pie represents categories.
small number of possible categories.





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50 workers over last 6 weeks

2, 2, 0, 0, 5, 8, 3, 4, 1, 0, 0, 7, 1, 7, 1, 5, 4, 0, 4, 0, 1, 8, 9, 7, 0, 1, 7, 2, 5, 5, 4, 3, 3, 0, 0, 2, 5, 1, 3, 0, 1, 0, 2, 4, 5, 0, 5, 7, 5, 1

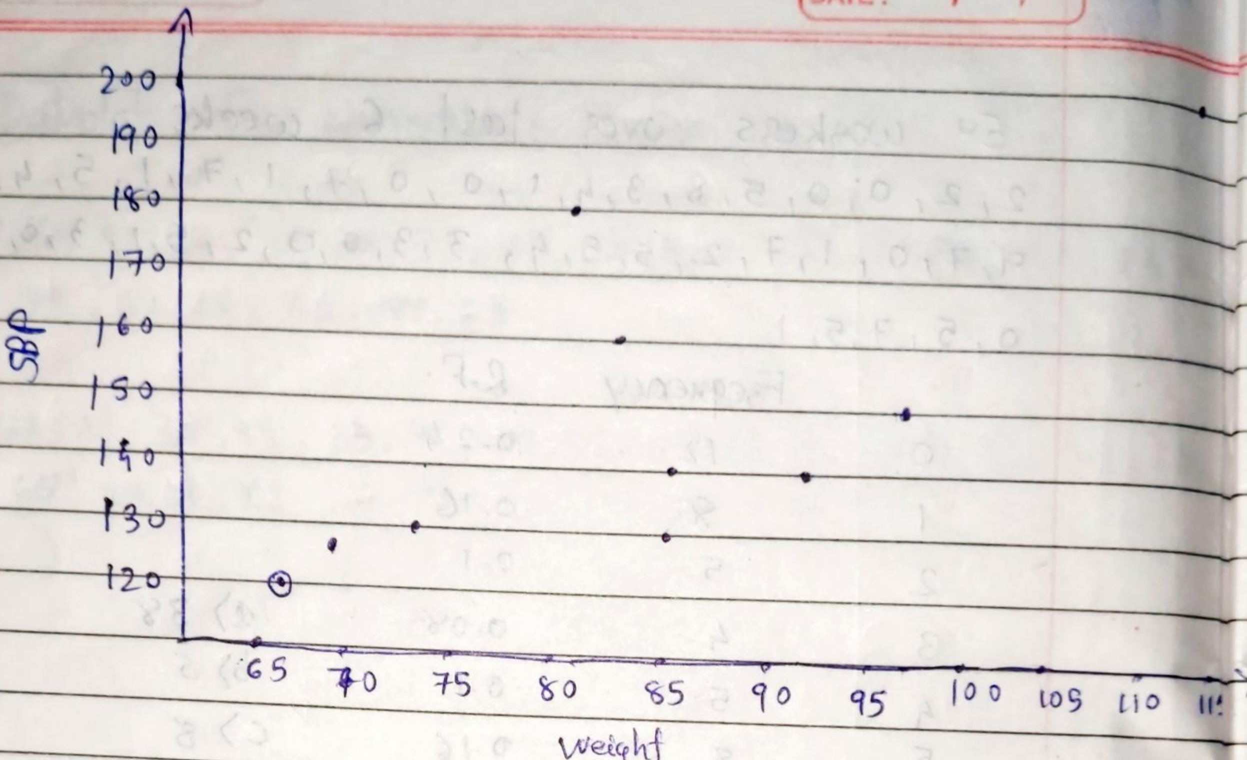
	Frequency	R.F.
0	12	0.24
1	8	0.16
2	5	0.1
3	4	0.08
4	5	0.1
5	8	0.16
6	0	
7	5	0.1
8	2	0.04
9	1	0.02

a) 38
b) 5
c) 8

✱ Scatter Diagram

Two quantitative variable
One is indepedent (x) and second is dependent (Y)
No frequency table. Points are joined.

67	69	85	83	74	81	97	92	114	85
120	125	140	160	130	180	150	140	200	130



✲ Simple correlation coefficient (r)

- Pearson's correlation or product moment correlation

→ measures the nature and strength

+ve increase

−ve decrease

✲ $-1 \leq r \leq 1$

strong intermediate weak weak inte.. strong

-1 -0.75 -0.25 0 0.25 0.75 1

perfect No relation perfect.

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$$r = \frac{\Sigma xy - \frac{\Sigma x \Sigma y}{n}}{\sqrt{\left(\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right)\left(\Sigma y^2 - \frac{(\Sigma y)^2}{n}\right)}}$$

x	y	x^2	y^2	xy
7	12	49	144	84
6	8	36	64	48
8	12	64	144	96
5	10	25	100	50
6	11	36	121	66
9	13	81	169	117
Σx = 41	Σy 66	Σx^2 291	Σy^2 742	Σxy 461

$$r = \frac{461 - 451}{\sqrt{(291 - 280.167)(742 - 726)}}$$

$$= \frac{10}{\sqrt{10.833 \times 16}} = \frac{10}{\sqrt{173.328}} = \frac{10}{13.1654}$$

$$= 0.7595$$

strong positive relationship.

X	Y	x^2	y^2	xy
10	2	100	4	20
8	3	64	9	24
2	9	4	81	18
1	7	1	49	7
5	6	25	36	30
6	5	36	25	30
32	32	230	204	129

$$r = \frac{129 - 170.667}{\sqrt{(230-170.667)(204-170.667)}}$$

$$= \frac{-41.667}{\sqrt{59.333 \times 33.333}}$$

$$= -\frac{41.667}{44.472}$$

$$= -0.9369$$

Negative strongly corelated.

Or

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

$\bar{x}$ = mean of x

$\bar{y}$ = mean of y

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★ Partial Correlation
→ measure of the strength and direction of a linear relationship between two continuous variable
— known as covariates or control variable

Assumption 1: one dependent and one independent both continuous
Assumption 2: one or more control variables. known as covariate.
Assumption 3: continuous

4: There needs to be a linear relationship between all 3 vars.
5: no significant outliers

6: approximately normally distributed

$$(xy.z) = \frac{(r_{xy} - r_{yz} * r_{zx})}{\sqrt{(1-r^2_{yz})(1-r^2_{zx})}}$$

x	y	z	$x-\bar{x}$	$y-\bar{y}$	$z-\bar{z}$	$(x-\bar{x})^2$	$(y-\bar{y})^2$	$(z-\bar{z})^2$	$(x-\bar{x})\cdot(y-\bar{y})$	$(y-\bar{y})(z-\bar{z})$	$(z-\bar{z})\cdot(x-\bar{x})$
10	29	17	-9	-14.88	-16	81	221.41	256	133.92	238.08	144
13	33	23	-6	-10.88	-10	36	118.37	100	65.28	108.8	60
19	41	21	0	-2.88	-12	0	8.29	144	0	34.56	0
16	47	29	-3	3.12	-4	9	9.73	16	-9.36	-12.48	12
13	51	37	-6	7.12	4	36	50.6944	16	-42.72	28.48	-24
21	43	41	2	-0.88	8	4	0.7744	64	-1.76	-7.04	16
23	31	39	4	-12.88	6	16	165.89	36	-51.52	-77.28	24
29	49	47	10	5.12	14	100	26.21	196	51.2	71.68	140
27	71	43	8	27.12	10	64	735.49	100	216.96	271.2	80
Σx	Σy	Σz									
171	395	297	0	0.08	0	346	1336.85	928	362	656	452
$\bar{x}$	$\bar{y}$	$\bar{z}$									
19	43.88	33									

$$r_{xy} = \frac{362}{\sqrt{346 \times 1336.65}} = \frac{362}{680.11} = 0.5322$$

$$r_{yz} = \frac{656}{\sqrt{1336.85 \times 928}} = \frac{656}{1113.62} = 0.5891$$

$$r_{xz} = \frac{452}{\sqrt{346 \times 928}} = \frac{452}{566.646} = 0.7976$$

$$r_{(xy.z)} = \frac{(0.5322 - 0.5891 \times 0.7976)}{\sqrt{(1-(0.5891)^2)\cdot(1-(0.7976)^2}}$$

$$= \frac{0.06233}{\sqrt{0.65296 \times 0.3638}} = \frac{0.06233}{\sqrt{0.2375}} = 0.1278$$

☆ Multiple correlation

three or more variable

$$R_{xyz} = \sqrt{\frac{r_{xz}^2 + r_{yz}^2 - 2 r_{xy} r_{yz} r_{zx}}{(1 - r_{xy}^2)}}$$

$$= \sqrt{\frac{(0.7976)^2 + (0.5891)^2 - 2(0.5322)(0.5891)(0.7976}{(1-(0.5322)^2}}$$

$$= \sqrt{\frac{0.4831}{0.7168}} = \sqrt{0.67396} = 0.8209$$

x	y	z	$x-\bar{x}$	$y-\bar{y}$	$z-\bar{z}$	$(x-\bar{x})^2$	$(y-\bar{y})^2$	$(z-\bar{z})$			
15	6	25	-0.3	1.2	-0.8	0.09	1.44	0.64	-0.36	-0.96	0.24
18	3	29	2.7	-1.8	3.2	7.29	3.24	10.24	-4.86	-5.76	8.64
13	8	27	-2.3	3.2	1.2	5.29	10.24	1.44	-7.36	3.84	-2.76
14	6	24	-1.3	1.2	-1.8	1.69	1.44	3.24	-1.56	-2.16	2.34
19	2	30	3.7	-2.8	4.2	13.69	7.84	17.64	-10.36	-11.76	15.54
11	3	21	-4.3	-1.8	-4.8	18.49	3.24	23.04	7.74	8.64	20.64
17	4	26	1.7	-0.8	0.2	2.89	0.64	0.04	-1.36	-0.16	0.34
20	4	31	4.7	-0.8	5.2	22.09	0.64	27.04	-3.76	-4.16	24.44
10	5	20	-5.3	0.2	-5.8	28.09	0.04	33.64	-1.06	-1.16	30.74
16	7	25	0.7	2.2	-0.8	0.49	4.84	0.64	1.54	-1.76	-0.56
Σ 153	48	258				100.1	~~28.76~~	117.6	-21.4	-15.4	99.6
15.3	4.8	25.8					33.6				

$$r_{xy} = \frac{-21.4}{\sqrt{100.1 \times \cancel{28.76}\ 33.6}} = \frac{-21.4}{\cancel{53.655}\ 57.9944} = \cancel{-0.3408}\ -0.369$$

$$r_{yz} = \frac{-15.4}{\sqrt{\cancel{28.76}\ 33.6 \times 117.6}} = \frac{-25.4}{\cancel{58.156}\ 62.8598} = -\cancel{0.265}\ -0.2449$$

$$r_{xz} = \frac{99.6}{\sqrt{100.1 \times 117.6}} = \frac{99.6}{108.497} = 0.9179$$

$$(xy.z) = \frac{(-0.3988 + (0.265)(0.9179)}{\sqrt{(1-(0.265)^2)(1-(0.9179)^2}}$$

$$= \frac{-0.15555}{\sqrt{0.1464}}$$

$$= \frac{-0.15555}{0.3826}$$

$$= -0.4064$$

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$$R_{xyz} = \sqrt{\frac{(0.3988)^2 + (0.265)^2 - 2(0.3988)(0.265)(0.9179)}{1-(0.3988)^2}}$$

$$= \sqrt{\frac{0.03525}{0.84095}} = \sqrt{0.04191} = 0.2047$$

☆ Regression Analyses

technique concerned with predicting some variables by knowing other.

→ Process of predicting one using another

Y = criterion x = predictor

slop = regression coefficient

intercept the = regression constant

$$\hat{y} = a + bx \qquad b_1 = \frac{SS_{xy}}{SS_{xx}}$$

$$\hat{y} = \bar{y} + b(x - \bar{x}) \qquad b_1 = \frac{\Sigma xy - \frac{\Sigma x \Sigma y}{n}}{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}$$

x	y	x^2	xy
7	12	49	84
6	8	36	48
8	12	64	96
5	10	25	50
6	11	36	66
9	13	81	117
41	66	291	461
$\bar{x}$	$\bar{y}$		
6.83	11		

$$b = \frac{461 - \frac{66 \times 41}{6}}{291 - \frac{(41)^2}{6}} = \frac{461 - 451}{291 - 280.167}$$

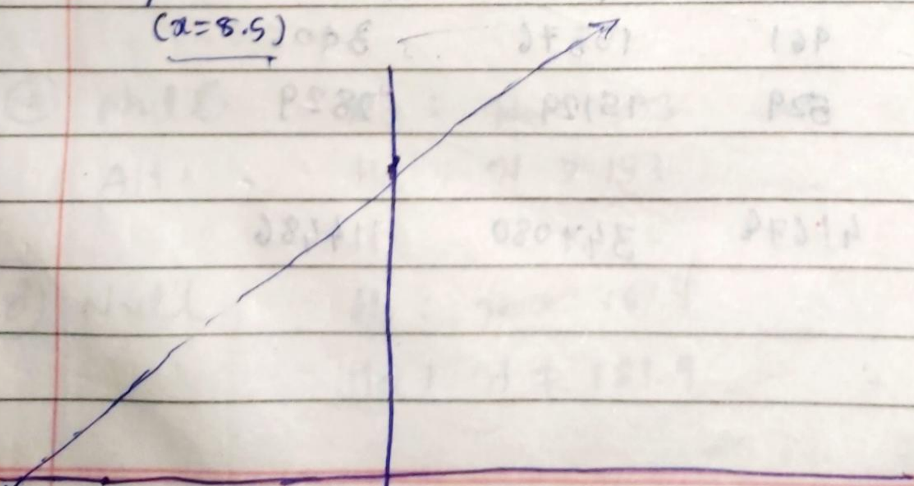
$$= \frac{10}{10.833} = 0.923$$

$$\hat{y} = 11 + 0.923(x - 6.83)$$

$$\hat{y} = 0.923x + 4.696$$

$$\hat{y}_{(x=8.5)} = 11 + 0.923(8.5 - 6.83) = 11 + 1.541$$

$$= 12.541$$



x	y	x^2	y^2	xy
20	120	400	~~16384~~ 14400	2400
43	128	1849	~~18496~~ 16384	5504
63	141	3969	19881	8883
26	126	676	15876	3276
53	134	2809	17956	7102
31	128	961	16384	3968
58	136	3364	18496	7888
46	132	2116	17424	6072
58	140	3364	19600	8120
70	144	4900	20736	10080
46	128	2116	16384	5888
53	136	2809	18496	7208
60	146	3600	21316	8760
20	124	400	15376	2480
63	143	3969	20449	9009
43	130	1849	16900	5590
26	124	676	15376	3224
19	121	361	14641	~~3906~~ 2299
31	126	961	15876	3906
23	123	529	15129	2829
Σ ~~798~~	~~2505~~			
852	2630	41678	347080	114486
$\bar{x}$	$\bar{y}$			
42.6	131.5			

$c = \mu + 6(Z\alpha)$ No need of unit.

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(a) The average July temperature in a region historically has been 74.5° F.

Null hypothesis $\mu = 74.5°F = H_0$

Alt. " $\mu > 74.5°F$

(b) The average weight of a female airline passenger with luggage was 145 pounds ten years ago. The FAA believes it to be higher now.

$H_0 : \mu = 145$ lb

$H_a : \mu > 145$ lb

(c) The average sti.

Q.2.

(a) Null hypothesis $H_0 : \mu = 38.2$

Alt. " $H_a : \mu < 38.2$

(b) Null $H_0 : \mu = 58291$

Alt. $H_a : \mu \neq 58291$

(c) Null $H_0 : \mu = 133$

Alt. $H_a : \mu > 133$

(d) Null $H_0 : \mu = 161.9$

$H_a : \mu \neq 161.9$

Sampling Distribution.

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Sample is random ⇒ every statistic is also random var.
varies from sample to sample

$A = \{152, 156, 160, 164\}$ $\mu = 158$

$\sigma = \sqrt{20}$

All posible samples

$\{(152, 152), (152, 156), (152, 160), (152, 164),$
$(156, 152), (156, 156), (156, 160), (156, 164),$
$(160, 152), (160, 156), (160, 160), (160, 164),$
$(164, 152), (164, 156), (164, 160), (164, 164)\}$

μ 152, 154, 156, 158, 154, 156, 158, 160, 156, 158, 160, 162, 158, 160, 162, 164

$\bar{x}$	152	154	156	158	160	162	164
$P(\bar{x})$	$\frac{1}{16}$	$\frac{2}{16}$	$\frac{3}{16}$	$\frac{4}{16}$	$\frac{3}{16}$	$\frac{2}{16}$	$\frac{1}{16}$
	1444	2964.5	4563	6241	4800	3280.5	1681

$\mu_{\bar{x}} = \Sigma \bar{x} P(\bar{x})$

$= 9.5 + 19.25 + 29.25 + 39.5 + 30 + 20.25 + 10.25$

$= 158.\cancel{25}$

$\mu = \mu_{\bar{x}}$ $\qquad$ $P(a < Z < b)$

$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}}$ $\quad$ n = samplesize PAGE: DATE: / / $\quad$ $\phi(b) - \phi(a)$

$Var(\bar{x}) = E(x^2) - (E(x))^2$ $\qquad$ $P(-z) = 1 - \phi(z)$

$= \cancel{29}\ 24974 - 24964$

$\sigma_{\bar{x}} = \sqrt{10} = 3.16\ldots$

Standard Normal Dist.

$\mu = 0, \quad \sigma = 1 \qquad Z \qquad \phi_z = P(Z \le z)$

(a) $P(z < 1.48) = \phi(1.48)$ $\quad$ b. $P(Z < -0.25) = 1 - \phi(0.20)$

$= 0.9306$ $\qquad$ $= 1 - 0.5987$

$= 0.4013$

(a) $P(z > 1.60) = 1 - P(z \le 1.6) = 1 - 0.9452$

$= 0.0548$

(b) $P(z > -1.02) = 1 - P(z \le -1.02) = 0.8461$

$= 1 - (1 - P(z \le 1.02)$

(a) $P(0.5 < z < 1.57) = \phi(1.57) - \phi(0.5)$

$= 0.9418 - 0.6915$

$= 0.2503$

(b) $P(-2.55 < z < 0.09) = \phi(0.09) - \phi(-2.55)$

$= 0.5359 - (1 - 0.9946)$

$= 0.5305$

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~~Eq~~ Prob. for General Normal

$$P(a < X < b) \Rightarrow P\left(\frac{a-\mu}{\sigma} < \underbrace{\frac{X-\mu}{\sigma}}_{Z} < \frac{b-\mu}{\sigma}\right)$$

$a, b \in R$

$\mu = 10 \quad \sigma = 2.5$

a. $P(X < 14)$

$$P\left(Z < \frac{14-10}{2.5}\right) = P(Z < 1.6)$$
$$= 0.9452$$

(b) $P(8 < X < 14) = P(-0.8 < Z < 1.6$

$$= 0.9452 - 1 + 0.7881$$
$$= 0.7333$$

Q2 $\mu = 37500$
$\sigma = 4500$

$$P(30000 < X < 40000) = P(-1.67 < Z < 0.556)$$
$$= 0.7123 + 0.9525 - 1$$
$$= 0.6648$$

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CLT

sample ≥ 30

normally distribution

sample mean $\mu_{\bar{x}} = \mu$

$$S.D. = \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

Large sample tests for a population mean

$$\frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

If σ is know $z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$

Standardized Test

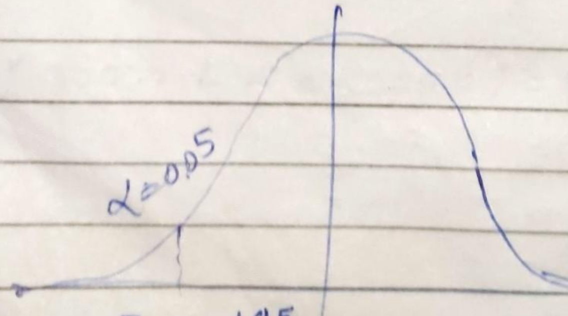
If σ is unknown $z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$

1 Identify the null and alternative hypothesis
2 Identify the relevant test statistic and its distribu[illegible]
3 compute from the data the value of the test statistic
4 Construct the rejection region
5 compare the value computed in 3 to the region constructed in 4 and make a decision.
Formulate the decision in the context of the problem

☆ It is hoped that a newly developed pain relieves will more quickly produce perceptible reduction in pain to patients after minor surgeries than a standard pain relieves. $\mu = 3.5$, $\sigma = 2.1$
$\bar{x} = 3.1$, $s = 1.5$

$H_0 : \mu = 3.5$
$H_a : \mu < 3.5$ @ $\alpha = 0.05$

$$z = \frac{3.1 - 3.5}{1.5/\sqrt{50}} = \frac{0.4}{1.5} \times 7.07 = 1.886$$



$Z = -1.886$ Reject H_0

A : number is 5
B : number is odd

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$
$$= \frac{1/6}{1/2} = \frac{1}{3}$$

$$P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{1/6}{1/6} = 1$$

A_1 : Laboratory 1
A_2 : " 2

$P(A_1) = 0.92$
$P(A_2) = 0.92$

i $P(A_1 \cap A_2) = 0.8464$

$P(A_1 \cup A_2) = 0.92 + 0.92 - 0.8464 = 0.9936$

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1) $R_x = \{0, 1, 2\}$ $S = \{HH, HT, TH, TT\}$

$P_x(x=0) = \frac{1}{4}$

$P_x(x=1) = \frac{2}{4} = \frac{1}{2}$

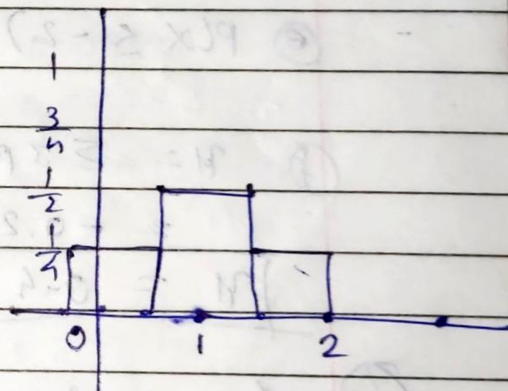
$P_x(x=2) = \frac{1}{4}$

x	0	1	2
$P(x)$	$1/4$	$1/2$	$1/4$

$P(x \geq 1) = P(1) + P(2)$

$= \frac{1}{2} + \frac{1}{4}$

$= \frac{3}{4}$



$E(x) = -0.42 + 0.33 + 0.48 + 0.735$

$\mu = E(x) = 1.135$

$E(x^2) = 0.42 + 0.34 + 0.96 + 2.5725$

$= 4.2925$

$= 3.004275$

x	-1	0	1	4
$p(x)$	0.2	0.5	a	0.1

$\boxed{a = 0.2}$ (a) $\Sigma p(x) = 1$

$0.8 + a = 1$

$a = 0.2$

(b) $P(0) = 0.5$

(c) $P(X > 0) = P(1) + P(4) = 0.2 + 0.1 = 0.3$

(d) $P(X \geq 0) = 1 - P(X = -1) = 1 - 0.2 = 0.8$

(e) $P(X \leq -2) = 0$

(f) $\mu = \Sigma x\, p(x)$

$= -0.2 + 0 + 0.2 + 0.4$

$\boxed{\mu = 0.4}$

(g) $\sigma^2 = \Sigma x^2 p(x) - (\Sigma x\, p(x))^2$

$\Sigma x^2 p(x) = 0.2 + 0.2 + 1.6$

$= 2$

$\sigma^2 = 2 - 0.16$

$\sigma^2 = 1.84$

(h) $\sigma = \cancel{0.6325}$ $\sigma = \cancel{0.7165}\ 1.3565$

$n - \quad x \quad\quad {}^{n}C_x \, p^{x} (q-p)^{n-x}$

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★ Binomial dist.^{n}

$$P(x) = \frac{n!}{x!\,(n-x)!} \, p^{x} q^{n-x} = {}^{n}C_x \, p^{x} q^{n-x}$$

$\mu = np \quad \sigma^2 = npq$

$n = 5, \quad p = 0.17 \quad q = 0.83 \quad\quad \sigma = \sqrt{npq}$

$P(x) = {}^{5}C_x (0.17)^{x} (0.83)^{5-x}$

$P(0) = {}^{5}C_0 (0.17)^{0} (0.83)^{5} = 0.3939$

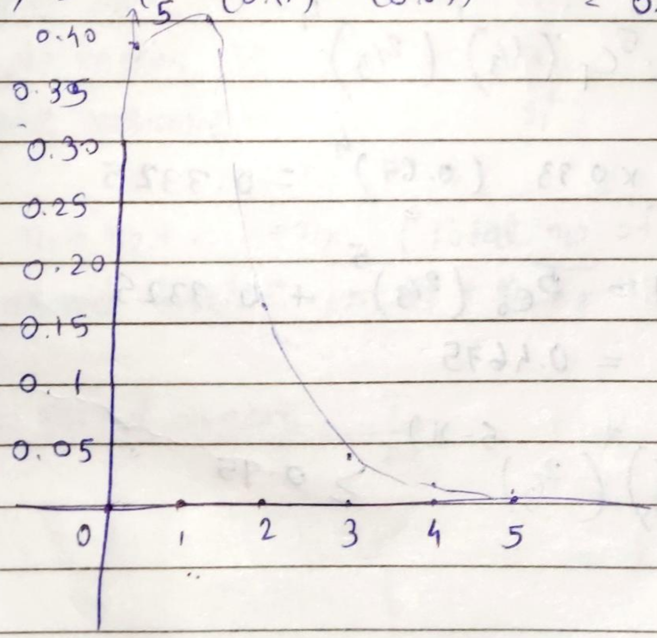
$P(1) = {}^{5}C_1 (0.17)^{1} (0.83)^{4} = 0.4034$

$P(2) = {}^{5}C_2 (0.17)^{2} (0.83)^{3} = 0.1652$

$P(3) = {}^{5}C_3 (0.17)^{3} (0.83)^{2} = 0.0338$

$P(4) = {}^{5}C_4 (0.17)^{4} (0.83)^{1} = 0.0035$

$P(5) = {}^{5}C_5 (0.17)^{5} (0.83)^{0} = 0.0001$



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$p = 0.5 \quad q = 0.5$

$(0.5)^{x}(0.5)^{10-x}$

$P(x) = {}^{10}C_x (0.5)^{10}$

$P(6) = {}^{10}C_6 (0.5)^{10}$

≈ 0.2051

(b) $P(x \geq 6) = 1 - P(x \leq 5)$

$= 1 - \left[\left({}^{10}C_0 + {}^{10}C_1 + {}^{10}C_2 + {}^{10}C_3 + {}^{10}C_4 + {}^{10}C_5\right)(0.5)^{10}\right]$

≈ 0.3770

$n = 5 \quad p = 1/3 \quad q = 2/3$

$P(1) = {}^5C_1 (1/3)^1 (2/3)^4$

$= 5 \times 0.33 \, (0.67)^4 = 0.3325$

$P(x \leq 1) = {}^5C_0 (2/3)^5 + 0.3325$

$= 0.4675$

${}^5C_x (1/3)^x (2/3)^{5-x} \geq 0.95$