23.04.2022

1) Chi-Square.
2) Semi-Variance.
3) ~~Anova~~.

Stock MKT.

ND. $f(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$

$-\infty < x < +\infty$

z_i is S.N.V.

$z_i = \frac{x_i - \mu}{\sigma}$

$z_i \sim ND(0,1)$

$\chi^2 = \sum z_i^2 = \sum \left(\frac{x_i - \mu}{\sigma}\right)^2$

// Sum of Square of SRV.

$0 < \chi^2 < +\infty$

Application
1) Independence of Attributes.
2) Test for population variance.
3) Goodness of fit.

Two Stocks from same sector.

Weekly We collected 84 months stock returns for two stocks.

Five number summary

min q_1 q_2 q_3 max.

Frequency Dist.

min – q_1 (Low) ⟶ 30

q_1 – q_2 (Average) ⟶ 30

q_2 - max (High) → 24 / 84

Stock 2

min - q_1 → 20
q_1 - q_2 → 45
q_2 - max → 19
84 (Data)

Levels

Stock 1 \ Stock 2	Low	Avg	High	
Low	5	15	10	30
Avg	10	1~~50~~5	~~10~~ 5	30
High	5	~~20~~ 15	4	24
	20	45	19	84

Levels

Given

Observed freq.

Null hyp: H_0: Stock 1 is ind. of Stock 2. No relation

H_1: There is a relation.

0-100000 100001- 3L >

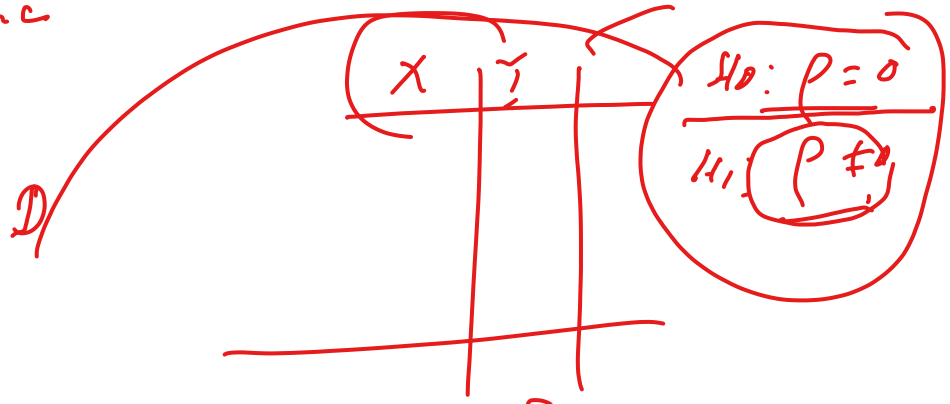
Education \ Income	Low	Avg	High	
LUG	50	30	~~20~~ 20	100 R_1
UG	✓	✓	✓	200 R_2
PG	Binomial	~~Sequen~~ Dis		100 R_3
7PG				100 R_4
	200 C_1	200 C_2	100 C_3	500

H_0: Education is ind. of Income

H_1: Depend

Test of Statistic

χ^2



Hint:

$$\chi^2 = \frac{\Sigma ((f_o) - f_e)^2}{f_e}$$

f_o = observed frequencies.

f_e = expected "

How we compute f_e?

$$f_1 = \frac{R_1 \times C_1}{N}$$

AH1 \ AH2	L_1	L_2	L_3	$N \times \frac{R_1}{N} \frac{C_1}{N}$
L_1	f_1	f_2	f_3	R_1
L_2	f_4	f_5	f_6	R_2
L_3	f_7	f_8	f_9	R_3
	C_1	C_2	C_3	N

$= \frac{R_1 C_1}{N}$

$$f_2 = \frac{R_1 \times C_2}{N}$$

$$f_3 = \frac{R_1 \times C_3}{N}$$

$\chi^2 = \frac{\Sigma (f_o - f_e)^2}{f_e}$ follows χ^2 dist. with $(R-1) \times (C-1)$ df.

p-value: R = no of rows

C = no of cols.

If p-value $< 0.05 \Rightarrow$ we reject H_0

| p-value > 0.05 => H_0 is accep.

Semi-variance.

84 months.

For each stock.

Step (1). First you compute ROR

ROR = Rate of return

$$= \frac{\text{Current} - \text{Previous}}{\text{Previous}}$$

83 months.

Using semi-variance To rank the stocks

30 stocks

Step (2) Calculate AROR $= \frac{\Sigma ROR}{83}$.

Step (3) (very) For each stock we calculate deviation of ROR from AROR.

	Return	RoR	RoR − AROR	−ve deviation	+ve deviation
1	R_1		−ve	−	
2	R_2	$R_2 - R_1 / R_1$	+ve	−	33
		$R_3 - R_2 / R_2$	.	−	$n_2 = 33$
.	.	.	.	−	
	.	.	.	50	
84	R_{84}	$R_{84} - R_{83} / R_{83}$	.	$n_1 = 50$	
		$\frac{\Sigma ROR}{83}$ = AROR			

We find. Positive Semi variance. based on the deviation on +ve deviation on 33 observation.

$$PSV = \frac{\Sigma (ROR - AROR)^2}{n_2 - 1}$$

$$NSV = \frac{\Sigma (ROR - AROR)^2}{n_1 - 1}$$

(8)

ROR	ROR - AROR	-ve dev	+ve
2	-3	-3	0
3	-2	-2	1
4	-1	-1	2
5	0		3
6	+1		
7	+2		
8	+3		

$n_1 = 3$

$n_2 = 4$

(-ve sq)	(+ve sq)
9	0
4	1
1	4
	9
$\Sigma = 14$	14

$$AROR = \frac{\Sigma ROR}{7} = \frac{35}{7} = 5$$

$$PSV = \frac{14}{3} = 4.66 \qquad NSV = \frac{14}{2} = 7$$

$$\frac{PSV}{NSV} = \frac{4.66}{7} = \text{(=)}$$

(30) $PSV > NSV$

$$\frac{PSV}{NSV}$$

(10) $\frac{PSV}{NSV} < 1$ ✓

$$\frac{PSV}{NSV} = 1.3, \quad 1.2 \quad (1.5)$$

Coefficient of variation (CV).

1) ROR. 2) AROR.

For each stock you calculate ROR & AROR → Return

From ROR. SDROR. Risk.

For each stock.

$$CV = \frac{SDROR}{AROR}$$

Per unit the risk that is w.r.t. to per unit of AROR.

CV is less that is good.

Sachin — Sonu

$$CV = \frac{SD}{mean}$$

100 — 100

Avg. return — Avg. return

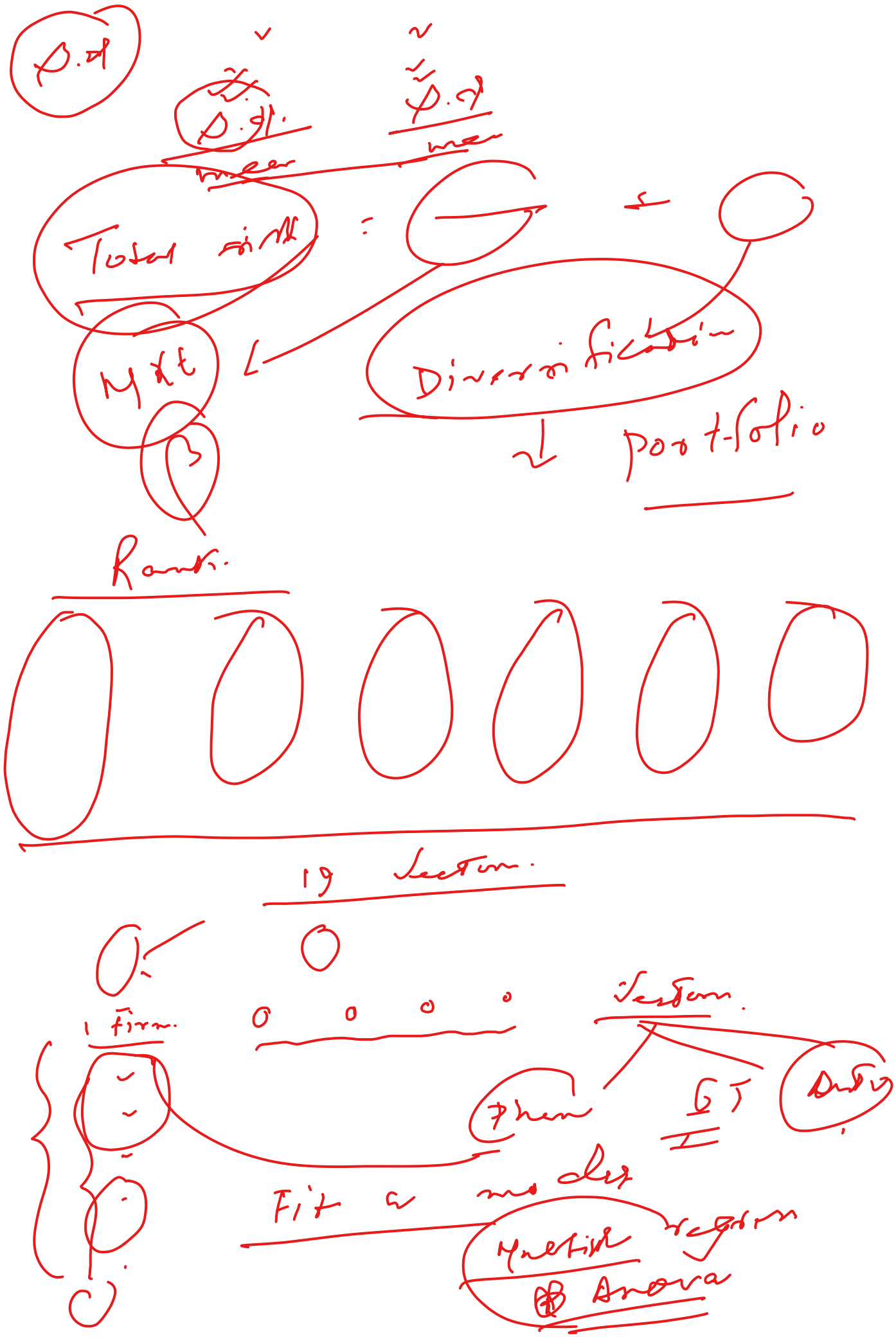
S.d. — S.d.

$$CV = \frac{SD}{mean}$$

Sachin	Sonu
100	50
100	50
0	40
0	50
0	10

$\frac{200}{5} = 40$ ✓

$\frac{200}{5} = 40$


D.d
D.d
D.d
Total risk
Mkt
Diversification
portfolio
Ranks
19 Sectors
1 firm
Sectors
Pharm
IT
Auto
Fit a model
Multiple regression
Anova

Scale:

Categorical

Nominal → Multiple

ordinal

Salary = f(Qualification, IQ, Gender).

GPA

Exp

PI

X_1, X_2, X_3

Y.

$Y = f(Q, IQ, G, Q \times IQ, IQ \times G)$

1) mean, s.d, corr, cov

2) Fine point. EDA.

3) Sk, kurtosis.

Graphics.

Visualization

Diagrams.

Prediction

Optimization

Prescriptive.

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