

SL no	Sp	Size	Age
1	✓	✓	✓
2	✓	✓	-
3		✓	-
id			

13.02.22.

Sp = 1 var.
Size & Age
= 2 var.

- (1) Sp no relation w size & Age.
- (2) Sp having association with size only.
- (3) Sp having association with age only.
- (4) Sp having association with size & Age.

Soln to Q1	Sp = Constant	no size no age
Soln to Q2	Sp = Constant + Coeff x size.	
Soln to Q3	Sp = Constant + Coeff x Age	
Soln to Q4	Sp = Constant + Coeff1 x size + Coeff2 x Age + Coeff3 x size x Age.	

Sp = y.

Q1
Q2
Q3
Q4

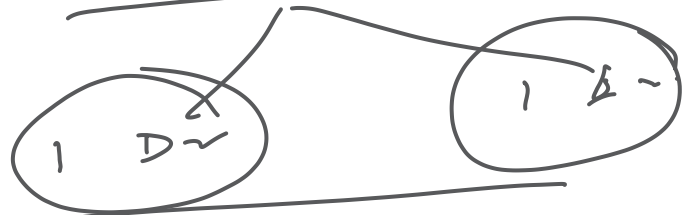
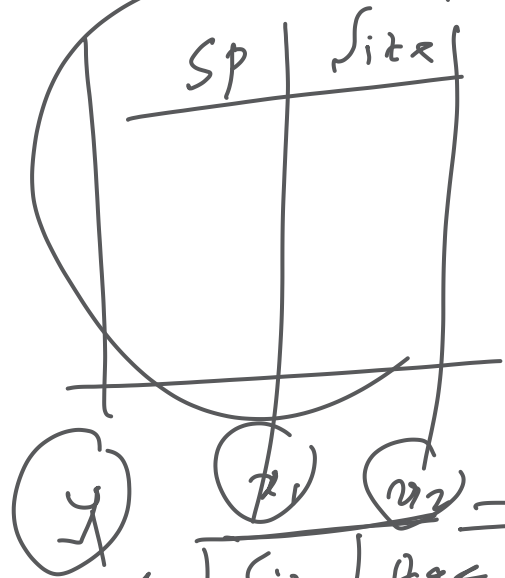
Size = x_1 Age = x_2

$y = \beta_0$ $y = \beta_0 + \beta_1 x_1$ $y = \beta_0 + \beta_2 x_2$ $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_1 x_2$	$\beta_0 = \text{Constant}$
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Objective: To Dr.

forecast or to predict for some given values of IV.

Two variables.



Simple Regression

more than 1 IV.

y depending on x_1 & x_2

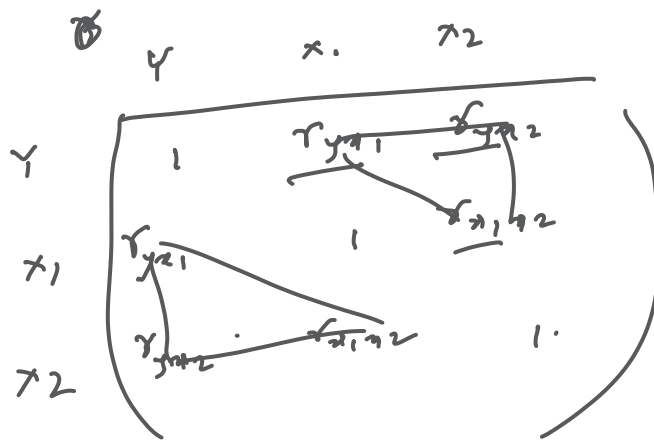
↓ multiple Regression

Sp	Size	Age

Why? $\rightarrow$ instead of $\frac{1}{R}$ $\frac{1}{R} \checkmark$
Three types of Correlation Coefficient

- ✓ (1) ✓ Simple Correlation Coefficient
- (2) ✓ Multiple " "
- (3) Canonical " "
- (4) Partial Correlation " "
- (5) Partial

Dr	IV	
1	1	SC. ✓
1	>1	MC. ✓
>1	>1	Canonical Cor.



$$r_{y, x1} = r_{x1, y}$$

$$r_{y, x2} = r_{x2, y}$$

$$r_{x1, x2} = r_{x2, x1}$$

$R_{y, x1, x2}$ = Correlation between y and x_1, x_2

DS. IV.

Multiple Correlation

$$y = \beta_0 + \beta_1 \text{ size}$$

$$SR \Rightarrow r^2$$

linear correlation between Y & IV

r^2 is very low

$$r^2 \rightarrow 0$$

$$r^2 \rightarrow 1 \Rightarrow$$

High linear correlation between Y & IV

occure

$$r^2 = 0.661$$

$$r^2 > 0.5$$

$$r^2 = 0.10$$

$$r^2 < 0.5$$

$$SR \rightarrow MR$$

$$r^2 = 0.91$$

$$r^2 = 0.661$$

Coefficient



explains

$$y = \text{at } b \text{ by}$$

$$r^2 = 0.90$$

$$10\%$$

$$1 - r^2 = \text{unexplained}$$

$$y = \beta_0 + \beta_1 x_1$$

$$y = 2 + 3x$$

$$\beta_0 = 2 \quad \beta_1 = 3$$

y	x ₁
✓ 1	1
✓ 2	2
✓ 3	3
✓ 4	4

Given
value

y	x	(y - $\bar{y}$)	(x - $\bar{x}$)	(x - $\bar{x}$) ²	(y - $\bar{y}$) ²	(x - $\bar{x}$)(y - $\bar{y}$)
✓ 2	1	-1.5	-1.5	2.25	2.25	2.25
✓ 3	2	-0.5	-0.5	0.25	0.25	0.25
✓ 4	3	0.5	0.5	0.25	0.25	0.25
✓ 5	4	1.5	1.5	2.25	2.25	2.25
$\bar{y} = \frac{14}{4} = 3.5$		$\bar{x} = \frac{10}{4} = 2.5$		$\sum (x - \bar{x})^2 = 5$	$\sum (y - \bar{y})^2 = 5$	$\sum (x - \bar{x})(y - \bar{y}) = 5$

$$r_{xy} = \frac{\text{Cov}(x, y)}{\text{SD of } x \times \text{SD of } y}$$

$$\text{Cov}(xy) = \frac{1}{n-1} \sum (x - \bar{x})(y - \bar{y}) = \frac{5}{3} = 1.66$$

$$S_x = \sqrt{\frac{1}{n-1} \sum (x - \bar{x})^2} = \sqrt{\frac{5}{3}} = \sqrt{1.66}$$

$$S_y = \sqrt{\frac{1}{n-1} \sum (y - \bar{y})^2} = \sqrt{\frac{5}{3}} = \sqrt{1.66}$$

$$r_{xy} = \frac{1.66}{\sqrt{1.66} \times \sqrt{1.66}} = 1$$

(β_0) (β_1)

The reg. eqⁿ of y on x [y depends on x]

$$y = \bar{y} + r \frac{S_y}{S_x} (x - \bar{x})$$

$$y = 3.5 + 1 \cdot \frac{1.6}{\sqrt{1.6}} (x - 2.5)$$

$$= 3.5 + (x - 2.5) = x + 1$$

Predicting
model

$$\hat{y} = x + 1$$

$$\beta_0 = 1$$

$$\beta_1 = 1$$

Observed	x	y	$\hat{y}$	$y - \hat{y}$	$\hat{y} = x + 1$
2	1	2	2	0	2
3	2	3	3	0	3
4	3	4	4	0	4
5	4	5	5	0	5

$$\sum (y - \hat{y})^2 = 0$$

Mean Sum of squares

$$MSE = \frac{1}{n} \sum (y - \hat{y})^2$$

Given

y	x_1	x_2

$$\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$

$y = f(x_1, x_2, x_3)$
 1) β_0
 2) $\beta_1, \beta_2, \beta_3$

$p = 20$

$2^{20} = 10,48,576$

	x_1	x_2	x_3	
Case ①	Ho dep. with x_1, x_2, x_3			$\Rightarrow \beta_0$
②	dep. with x_1 only			$\Rightarrow \beta_0 + \beta_1 x_1$
③	dep. with x_2 only			$\Rightarrow \beta_0 + \beta_2 x_2$
④	dep. with x_3 only			$\Rightarrow \beta_0 + \beta_3 x_3$
⑤	dep. with x_1, x_2			$\Rightarrow \beta_0 + \beta_4 x_1 + \beta_5 x_2$
⑥	dep. with x_1, x_3			$\Rightarrow \beta_0 + \beta_6 x_1 + \beta_7 x_3$
⑦	dep. with x_2, x_3			$\Rightarrow \beta_0 + \beta_8 x_2 + \beta_9 x_3$
⑧	dep. with x_1, x_2, x_3			$\Rightarrow \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3$

$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_1 x_2 + \beta_5 x_1 x_3 + \beta_6 x_2 x_3 + \beta_7 x_1 x_2 x_3$

$\beta_4 \rightarrow 0 \quad \beta_5 \rightarrow 0 \quad \beta_6 \rightarrow 0 \quad \beta_7 \rightarrow 0$

$2^3 = 8$

$$y = \beta_0 + \beta_1 x_1 + \beta_2 (x_1)^2 + \beta_3 x_3$$

(Sp)

~~Adventure = f(Tv, Radio, snow).~~

~~$y = f(x_1, x_2, x_3)$~~

$y = f(x_1, x_3)$

β

$R^2 = 0.9$

$R^2 = 0.89$

