

Exercise 3

1. Permutation

$$\text{formula: } P_r^n = \frac{n!}{(n-r)!}$$

n = amount

r = how you want it arranged.

$$P_4^8 = \frac{8!}{(8-4)!} = \frac{8!}{4!} = \frac{8 \cdot 7 \cdot 6 \cdot 5 \cdot \cancel{4!}}{\cancel{4!}} = 1680 //$$

2. Combination

$$\text{formula: } C_r^n = \frac{n!}{r!(n-r)!}$$

n = amount

r = items randomly ~~set~~ selected

$$C_4^7 = \frac{7!}{4!(7-4)!} = \frac{7!}{4!3!} = \frac{7!}{3!4!} = 35 //$$

3. Combination

$$\text{formula: } C_r^n = \frac{n!}{(n-r)!r!}$$

$$C_3^{10} = \frac{10!}{(10-3)!3!} = \frac{10!}{7!3!} = \frac{10 \cdot 9 \cdot 8 \cdot \cancel{7!}}{\cancel{7!} 3 \cdot 2} = \frac{720}{6} = 120$$

$$C_2^{15} = \frac{15!}{(15-2)!2!} = \frac{15!}{13!2!} = \frac{15 \cdot 14 \cdot \cancel{13!}}{\cancel{13!} 2} = \frac{15 \cdot 14}{2} = \frac{210}{2} = 105$$

$$C_5^{25} = \frac{25!}{(25-5)!5!} = \frac{25!}{20!5!} = \frac{25 \cdot 24 \cdot 23 \cdot 22 \cdot 21 \cdot \cancel{20!}}{\cancel{20!} 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} = 53130$$

$$P = \frac{120 \times 105}{53130} = \frac{12600}{53130} = 0.2372 \approx 23.72\%$$

Exercise 2

1. $Q_1 = 18$
 $Q_2 = 30$
 $Q_3 = 42$

$$T_{\text{mean}} = \frac{Q_1 + 2Q_2 + Q_3}{4} = \frac{18 + 60 + 42}{4}$$
$$= 30$$

2. $GM = \left(\prod_{i=1}^n (1+g_i) \right)^{\frac{1}{n}}$

$$= (1.05) \cdot (1.10) \cdot (0.97) \cdot (1.06)$$
$$= \sqrt[4]{1.05 \times 1.10 \times 0.97 \times 1.06}$$
$$= 1.044 - 1 = 0.044 = 4.4\% \text{ Per year.}$$

3. ~~68~~, 70, 72, 75, 80, 85, 90, 92, ~~100~~

$$\frac{70 + 72 + 75 + 80 + 85 + 90 + 92}{8}$$

$$10\% = 82.375$$

Finding SD

formula

$$SD = \sqrt{\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2} \rightarrow \begin{array}{l} \text{use } n \text{ for regular SD (Population)} \\ \text{use } n-1 \text{ for } t\text{-test (sample)} \end{array}$$

x_i = every of the data

\bar{x} = mean of ~~every~~ all data.

Exercise 4

1.

$$\text{Year 1: } \cancel{0.10} + 1 = 1.10$$

$$\text{Year 2: } 0.15 + 1 = 1.15$$

$$\text{Year 3: } -0.05 + 1 = 0.95$$

$$\text{Year 4: } 0.08 + 1 = 1.08$$

$$\text{Year 5: } 0.12 + 1 = 1.12$$

$$\sqrt[5]{(1.10) \cdot (1.15) \cdot (0.95) \cdot (1.08) \cdot (1.12)}$$
$$= 1.078$$

$$1.078 - 1 = 0.078$$

$$0.078 \times 100 = 7.8\%$$

2.

Group A

min : 7

25th : 9

50th : 13

75th : 15

max : 16

Exercise 7

1. one way ANOVA = F-Table

① Make the hypothesis

H_0 : All means for different fertilizers are the same

H_1 : There is at least one difference

② Find mean for A, B & C

$$\bar{X}_a = 15.4 \quad \bar{X} = 19.53$$

$$\bar{X}_b = 20.4$$

$$\bar{X}_c = 26$$

③ Sum of Squares

$$SST = \sum (\bar{X}_i - \bar{X})^2$$

→
All the data minus w overall mean +rs u squared & add them all

$$(15 - 19.53)^2 + \dots + (24 - 19.53)^2 = t$$

$$SSB = n \sum (\bar{X}_i - \bar{X})^2$$

→
~~overall~~ mean - overall mean +rs squared

$$t = 3[(15.4 - 19.53)^2 + (20.4 - 19.53)^2 + (26 - 19.53)^2] = b$$

$$SSE = t - B = e$$

④ degree of freedom

$$df_B = n - 1 = 3 - 1 = 2$$

$$df_E = N - n = 15 - 3 = 12$$

$$\left. \begin{array}{l} MSB = \frac{b}{df_B} = m_b \\ MSE = \frac{e}{df_E} = m_e \end{array} \right\} F = \frac{m_b}{m_e}$$

⑤ Crit value

$$df_B \text{ & } df_E = 2 \text{ & } 12$$

$$C = 2.81 \text{ } 3.8853$$

If F value is far value is far beyond the crit val, reject H_0 .

2. Chi-squared

① Make hypothesis

H_0 : The observed matches expected

H_1 : observed does not match expectation

② formula:

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

O : observed
 E : expected

$$E_{ij} = \frac{\sum R \times \sum C}{\sum G}$$

Row Column

$$= \frac{40 \times 30}{90} = \frac{1200}{90} =$$

$\frac{1200}{90}$	$\frac{1400}{90}$	$\frac{1000}{90}$
$\frac{900}{90}$	$\frac{1050}{90}$	$\frac{750}{90}$
$\frac{600}{90}$	$\frac{700}{90}$	$\frac{500}{90}$

O_{ij} = Data

$$\chi^2 = \left(\frac{10 - \frac{1200}{90}}{\frac{1200}{90}} \right)^2 + \dots \left(\frac{10 - \frac{500}{90}}{\frac{500}{90}} \right)^2 = \chi^2$$

test score

③ degree of freedom

$$df = (\underset{\substack{\uparrow \\ \text{row}}}{r} - 1) (\underset{\substack{\uparrow \\ \text{column}}}{c} - 1) = (3 - 1) (3 - 1) = (2)(2) = 4$$

④ Crit val by chi-squared table

$$C = 9.488$$

⑤ conclusion

if χ^2 is more than the crit val, reject H_0 .

klo ga failure to reject.

3. Two way ANOVA

① Define hypothesis

H_0 = Lang & Stud Method does not have any effect on the variables & have no interaction

H_1 = (opposite H_0)

$$\textcircled{2} \bar{X} = \frac{78 + 82 + 85 + 90 + 88 + 92}{6 \times 3} =$$

$$\bar{X}_{R1} = \frac{78 + 82 + 85 + 90 + 88 + 92}{6}$$

\bar{X}_{R2} = count per row

\bar{X}_{R3} =

$$\bar{X}_{C1} = \frac{78 + 82 + 85 + 90 + 88 + 92}{6}$$

$$\bar{X}_{C2} =$$

$$\textcircled{3} SST = \sum (x_i - \bar{X})^2 = (78 - \bar{X})^2 + \dots + (90 - \bar{X})^2 = SST$$

$$\textcircled{4} SSB = R \rightarrow \text{numb of row} \cdot \sum (\bar{X}_R - \bar{X})^2 = 2 [(\bar{X}_{R1} - \bar{X})^2 + \dots + (\bar{X}_{R3} - \bar{X})^2]$$

$$C \rightarrow \text{numb of column} \cdot \sum (\bar{X}_C - \bar{X})^2 = 3 [(\bar{X}_{C1} - \bar{X})^2 + (\bar{X}_{C2} - \bar{X})^2]$$

$$I \rightarrow \sum \sum n_{ij} (\bar{X}_{ij} - \bar{X}_i - \bar{X}_j + \bar{X})^2$$

$$= 3 \left(\frac{78 + 82 + 85}{3} - \bar{X}_{R1} - \bar{X}_{C1} + \bar{X} \right)^2 + 3 \left(\frac{90 + 88 + 92}{3} - \bar{X}_{R1} - \bar{X}_{C2} + \bar{X} \right)^2$$

$$+ \dots 3 \left(\frac{78 + 75 + 80}{3} - \bar{X}_{R3} - \bar{X}_{C2} + \bar{X} \right)^2 =$$

$$SSE = \sum (X_{ijk} - \bar{X}_0)^2$$

$$= (78 - \frac{78 + 82 + 85}{3})^2 + (82 - \frac{78 + 82 + 85}{3})^2 + \dots + (80 - \frac{78 + 75 + 80}{3})^2$$

Find degrees of freedom

$$df \text{ Row} : r - 1 = 2$$

$$df \text{ Column} : c - 1 = 1$$

$$df \text{ Interactions} : (r - 1)(c - 1) = 2 \cdot 1 = 2$$

$$df \text{ Error} : N - \text{row} \times \text{column} = 18 - (3 \cdot 2) = 12$$

$$df \text{ Total} : \text{numb of observation} - 1 = 18 - 1 = 17$$

Conclude

Compare F-val & crit val

if F val is more than crit val, ~~not~~ reject H_0

$$MSBR = \frac{SSB \text{ row}}{dfr}$$

$$MSBC = \frac{SSB \text{ column}}{dfc}$$

$$MSBI = \frac{SSB I}{dfI}$$

$$MSE = \frac{SSE}{dfe}$$

Crit val

$$CR_{FR} = \frac{dfr}{2 \text{ \& } dfe} = 3.89$$

$$CR_{FC} = \frac{dfc}{1 \text{ \& } dfe} = 4.75$$

$$CR_{FI} = \frac{dfI}{2 \text{ \& } dfe} = 3.89$$

F-val

$$FR = \frac{MSBR}{MSE}$$

$$FB = \frac{MSBC}{MSE}$$

$$FI = \frac{MSBI}{MSE}$$

compare

Lang & Stud

Strongy method

both.

Exercise 4

1. Percentage returns.

2.

3. and = multiply

or = either one

$$P(A \text{ \& } B) = P(A) \cdot P(B)$$

$$P(A/B) = P(A) + P(B) - P(A \text{ \& } B)$$

$$\frac{4}{52} \times \frac{1}{2} = \frac{4}{104} = \frac{2}{52} //$$

4.

x		y
9 7 4 2	1	3 6 8
8 6 4 1	2	0 3 5 7 9
2 0	3	9 3

$$5. P = C_x^n \cdot p^x q^{n-x}$$

n = numb of experiments

x = numb of success

p = probability of success

q = probability of fail (1 - p)

$$C_3^5 \cdot \left(\frac{1}{2}\right)^3 \left(\frac{1}{2}\right)^{5-3}$$

$$= \frac{5!}{3!2!} \cdot \frac{1}{8} \cdot \frac{1}{4} = \frac{10}{32} = \frac{5}{16} //$$