Exercise 3

1. Permutation

formula: $P^n_r = \dfrac{n!}{(n-r)!}$

n = amount
r = how you want it arranged.

$$P^8_4 = \frac{8!}{(8-4)!} = \frac{8!}{4!} = \frac{8\cdot 7\cdot 6\cdot 5\cdot \cancel{4!}}{\cancel{4!}} = 1680$$

2. Combination

formula: $C^n_r = \cancel{\dfrac{n!}{r!(n+r)!}}\ \dfrac{n!}{(n-r)!\,r!}$

n = amount
r = items randomly ~~selete~~ selected

$$C^7_4 = \cancel{\frac{7!}{4!(7+4)!}}\ \frac{7!}{(7-4)!\,4!} = \frac{7!}{3!\,4!} = 35$$

3. Combination

formula: $C^n_r = \dfrac{n!}{(n-r)!\,r!}$

$$C^{10}_3 = \frac{10!}{(10-3)!\,3!} = \frac{10!}{7!\,3!} = \frac{10\cdot 9\cdot 8\cdot \cancel{7!}}{\cancel{7!}\ 3\cdot 2} = \frac{720}{6} = 120$$

$$C^{15}_2 = \frac{15!}{(15-2)!\,2!} = \frac{15!}{13!\,2!} = \frac{15\cdot 14\cdot \cancel{13!}}{\cancel{13!}\ 2} = \frac{15\cdot 14}{2} = \frac{210}{2} = 105$$

$$C^{25}_5 = \frac{25!}{(25-5)!\,5!} = \frac{25!}{20!\,5!} = \frac{25\cdot 24\cdot 23\cdot 22\cdot 21\cdot \cancel{20!}}{\cancel{20!}\ 5\cdot 4\cdot 3\cdot 2\cdot 1} = 53\,130$$

$$P = \frac{120\times 105}{53\,130} = \frac{12\,600}{53\,130} = 0.2372 \approx 23.72\%$$

Exercise 2

1.

$Q_1 = 18$

$Q_2 = 30$

$Q_3 = 42$

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

$$= 30$$

2.

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

$$= (1.05) \cdot (1.10) \cdot (0.97) \cdot (1.06)$$

$$= \sqrt[4]{1.05 \times 1.10 \times 0.97 \times 1.06}$$

$$= 1.044 - 1 = 0.044 = 4.4\%$$ per year.

3.

$\cancel{68}$, 70, 72, 75, 80, 85, 90, 92, $\cancel{100}$

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

$10\% = 82.375$

Finding SD

Formula

$$SD = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

→ use n for regular SD (Population)

use $n-1$ for t-test (sample)

x_i : every of the data

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

Exercise 4

1.

Year 1 : $\cancel{0.0}$ $0.10 + 1 = 1.10$

Year 2 : $0.15 + 1 = 1.15$

year 3 : $-0.05 + 1 = 0.95$

Year 4 : $0.08 + 1 = 1.08$

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

25^{th} : 9

50^{th} : 13

75^{th} : 15

max : 16

Exercise 7

1. one way ANOVA = F-Table

① Make the hypothsis

H_0 : All means for differet fertilizers are the same

H_1 : There is at least one difference

② Find mean for A, B & C

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

$\bar{X}_b = 20.4$

$\bar{X}_c = 26$

⑤ Crit Value

df_B & df_e = 2 & 12

C = ~~2.81~~ 3.8853

If F value is far value is far beyond the crit val, reject H0.

③ sum of squares

$SST = \sum(\bar{x}_{ij} - \bar{X})^2$

All the data minus w overall mean trs u squared & add them all

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

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

~~overall~~ mean - overall mean trs squared

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

$SSE = t - B = e$

④ degree of freedom

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

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

$MSB = \frac{b}{dfb} = mb$

$MSE = \frac{e}{dfe} = me$

$F = \frac{mb}{me}$

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

$$E_{ij} = \frac{\Sigma R \times \Sigma C}{\Sigma G} = \frac{40 \times 30}{90} = \cancel{\frac{1200}{90}} =$$

ΣR: row, ΣC: column

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

O_{ij} = Data

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

test score

③ degree of freedom

$$df = (r-1)(c-1) = (3-1)(3-1) = (2)(2) = 4$$

r: row, c: column

④ Crit val by chi-squared table

C = 9.488

⑤ conclusion

if χ^2 is more than the 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)

② $\bar{X} = \frac{78+82+85+90 \dots 75+80}{6 \times 3} =$

$\bar{X}_{R_1} = \frac{78+82+85+90+88+92}{6}$

$\bar{X}_{R_2}$ = count per row

$\bar{X}_{R_3}$ = —"—

$\bar{X}_{C_1} = \frac{78+82+85+72+72 \dots +68 +78}{9}$

$\bar{X}_{C_2}$ = —"—

③ $SST = \sum (x_i - \bar{x}) = (78-\bar{x})^2 + \dots (80-\bar{x})^2 = SST$

④ SSB = R → numb of Row $\cdot \sum(\bar{X}_R - \bar{x})^2 = 2\left[(\bar{x}_{R_1} - \bar{x})^2 + \dots (\bar{x}_{R_3} - \bar{x})^2\right]$

C → numb of column $\cdot \sum(\bar{x}_c - \bar{x})^2 = 3\left[(\bar{x}_{C_1} - \bar{x})^2 + (\bar{x}_{C_2} - \bar{x})^2\right]$

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

$= 3\left(\frac{78+82+85}{3} - \bar{X}_{R_1} - \bar{X}_{C_1} + \bar{X}\right)^2 + 3\left(\frac{90+88+92}{3} - \bar{X}_{R_1} - \bar{X}_{C_2} + \bar{X}\right)^2$

mean of row 1 — mean of Column 1 — mean of Row 1 — mean of Column 2

$+ \dots 3\left(\frac{78+75+80}{3} - \bar{X}_{R_3} - \bar{X}_{C_2} + \bar{X}\right)^2 =$

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

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

Find degrees of freedom

df Row : $r - 1 = 2$

df Column : $c - 1 = 1$

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

df Error : N − (row × column) = $18 - (3 \cdot 2) = 12$

df Total : numb of observation $-1 = 18 - 1 = 17$ (brp data)

$MSB_R = \frac{SSB\ row}{df_r}$

$MSB_C = \frac{SSB\ column}{df_c}$

$MSB_I = \frac{SSB_I}{df_I}$

$MSB_E = \frac{SSE}{df_E}$

Crit val

C_R = df_R & df_e = 2 & 12 = 3.89

C_C = df_c & df_e = 1 & 12 = 4.75

C_I = df_i & df_e = 2 & 12 = 3.89

F-val

$F_R = \frac{MSB_R}{MSE}$

$F_B = \frac{MSB_C}{MSE}$

$F_i = \frac{MSB_I}{MSE}$

compare

Lang-mne

Study Methe

both.

Conclude

Compare F-val & crit

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