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Home Work 7

BME 7410

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4.2 Treatment of Kawasaki Disease:

Null Hypothesis: The new treatment method has no significant effect compared to the placebo group, i.e.,

$$H_0 : \mu_1 = \mu_2 \quad \text{[mean of both groups are same]}$$

Two-sample t-test:

For treatment group, $n_1 = 95$, $\bar{x}_1 = 1.31$, $S_1 = 1.55$

For placebo group, $n_2 = 95$, $\bar{x}_2 = 1.39$, $S_2 = 2.03$

$$\therefore S_p = \sqrt{\frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1+n_2-2}}$$

$$= \sqrt{\frac{(95-1)(1.31)^2 + (95-1)(1.39)^2}{95+95-2}}$$

$$= 1.81$$

$$\therefore S_E = S_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}} = 1.81\sqrt{\frac{1}{95}+\frac{1}{95}} = 0.26$$

$$\therefore t = \frac{|\bar{x}_1 - \bar{x}_2|}{S_E} = \frac{|1.31 - 1.39|}{0.26} = 0.31$$

where $df = n_1 + n_2 - 2 = 95 + 95 - 2 = 188$

From, t-distribution table, p is between 1 to 0.5.

Hence, we cannot reject the Null Hypothesis.

4.8 Weight gain from type-II diabetes treatment:

Null Hypothesis: The three treatments did not produce any differential weight gain in patients, i.e.,

$H_0 : \mu_1 = \mu_2 = \mu_3$ [mean of all three populations are same]

Here,

	Group 1	Group 2	Group 3
# of patients, n	10	11	8
Average weight gain, $\bar{x}$	3.51	7.5091	7.6375
Standard deviation, s	6.1334	4.6229	3.9849

Mean and standard deviations were calculated using Matlab.

Now, within-groups variance,

$$s_w^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2 + (n_3-1)s_3^2}{n_1+n_2+n_3-3}$$

$$= \frac{(10-1)(6.1334)^2 + (11-1)(4.6229)^2 + (8-1)(3.9849)^2}{10+11+8-3}$$

$$= 25.51675$$

$$\text{grand mean, } \bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2 + n_3\bar{x}_3}{n_1+n_2+n_3}$$

$$= \frac{10\times 3.51 + 11\times 7.5091 + 8\times 7.6375}{10+11+8}$$

$$= 6.1655$$

Between-groups variance:

$$s_B^2 = \frac{n_1(\bar{x}_1 - \bar{x})^2 + n_2(\bar{x}_2 - \bar{x})^2 + n_3(\bar{x}_3 - \bar{x})^2}{k-1}$$

$$= \frac{10(3.51 - 6.1655)^2 + 11(7.5091 - 6.1655)^2 + 8(7.6375 - 6.1655)^2}{3-1}$$

$$= 53.8545$$

$$\therefore F_{k-1,\,n-k} = \frac{s_B^2}{s_W^2}$$

$$\Rightarrow F_{2,26} = \frac{53.8545}{25.51675} = 2.11$$

Using fcdf function, we get $p = 0.1415$.

Hence we can not reject the null hypothesis, i.e., the group's means can be identical.

Matlab script:

```
%all three treatmeant groups
a= [13.5 6.9 4.2 9.6 -7.6 5.5 3.2 -3.6 0.1 3.3];
b= [-0.7 16.8 7.6 4.4 7.6 3.9 4.2 10.7 10.3 10.4 7.4];
c= [0.1 9 13.2 7.9 10.5 9 4.3 7.1];

%means
x1_bar = mean(a);
x2_bar = mean(b);
x3_bar = mean(c);

%standard deviations
s1 = std(a);
s2 = std(b);
s3 = std(c);

%calculating p value for df1=2, df2=26, and F=2.11
p = 1-fcdf(2.11, 2, 26);

%reproducing the p value using anova1 function
y = [a,b,c];
group = repelem(1:3, 1, [numel(a),numel(b),numel(c)]);

prob = anova1(y, group);
```

Values:

X1_bar = 3.51

X2_bar = 7.5091

X3_bar = 7.6375

S1 = 6.1334

S2 = 4.6229

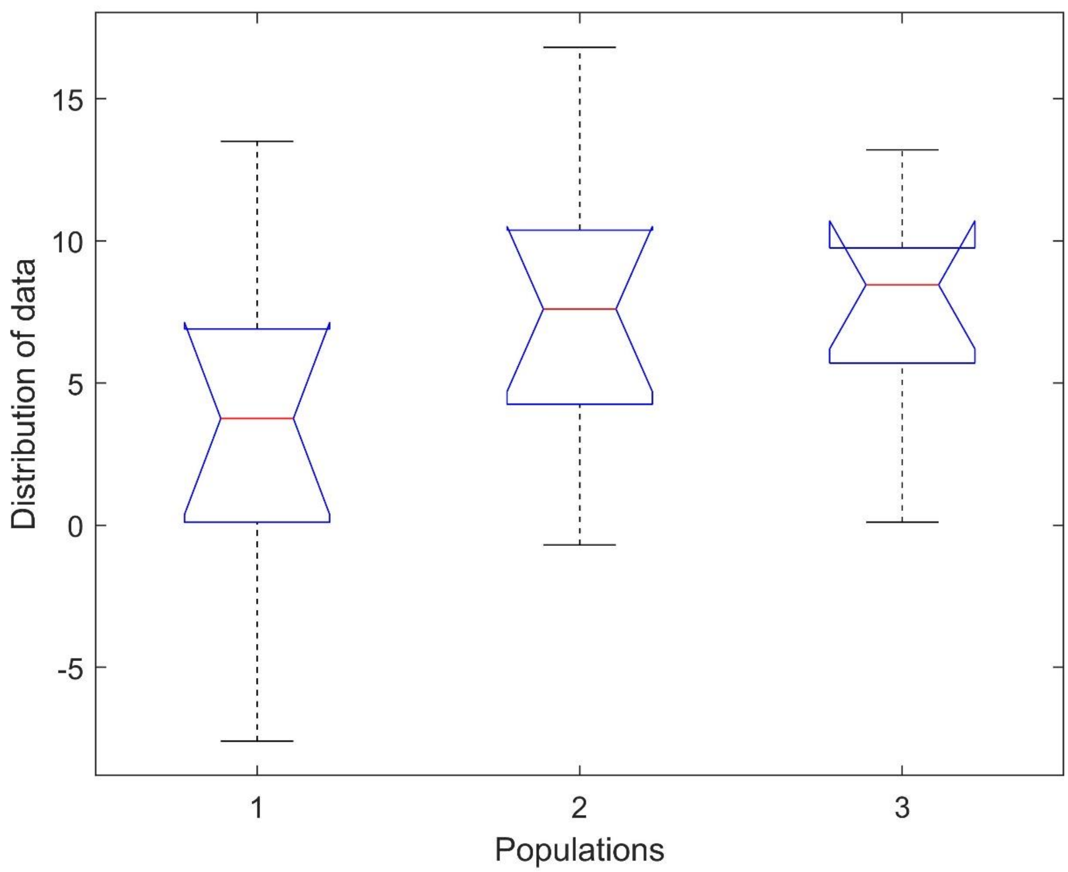
S3 = 3.9849

P = 0.1415

Prob = 0.1415

ANOVA Table

Source	SS	df	MS	F	Prob>F
Groups	107.709	2	53.8543	2.11	0.1415
Error	663.437	26	25.5168		
Total	771.146	28			



Since the hand calculation results match with the output of anova1 function, we can say that the calculations were correct.