Lab no.1

- From the following trivalent distribution compute all possible partial correlations.

X1	X2	X3
8	10	7
20	30	12
16	25	8
9	14	6
12	16	5
20	24	4
15	20	6

Solution:

The partial correlation between the first and second variables keeping the effect of the third variable constant is given by 0.970.

Correlations

Control Variables			X1	X2
X3	X1	Correlation	1.000	.970**
	X2	Correlation	.970**	1.000

The partial correlation between the second and third variable keeping the effect of the first variable constant is given by 0.775.

Correlations

Control Variables			X2	X3
X1	X2	Correlation	1.000	.775
	X3	Correlation	.775	1.000

The partial correlation between the First and third variables keeping the effect of the second variable constant is given by -0.707.

Correlations

Control Variables	X1	X3

X2	X1	Correlation	1.000	-.707
	X3	Correlation	-.707	1.000

Lab no.2:

- A researcher wants to study the correlation between rent no of room and distance from town. The following data are gathered by him.

Rent (000)	No of room	Distance
10	1	3
15	2	5
30	5	2
25	3	2
45	6	1
35	5	3
50	6	3

a. Compute the correlation between rent and no of rooms and keep the as distance constant.

Correlations

Control Variables			X1	X2
X3	X1	Correlation	1.000	.950**
	X2	Correlation	.950**	1.000

The correlation between rent and no of rooms and keeping the distance constant is 0.950.

a. Compute the correlation between rent and distance and keep the no of room constant.

Correlations

Control Variables			X1	X3
X2	X1	Correlation	1.000	.065
	X3	Correlation	.065	1.000

The correlation between rent and no of rooms and keeping the distance constant is 0.065.

Lab no. 3 (INDEPENDENT T TEST)

- The operating time of two different brands of mobile is given below:

color	4.6	5.4	3.9	6.0	5.6	7.2	5.6	5.8	6.2
vivo	5.1	6.8	4.9	7.2	7	6.5	5.2	4.8	4

Is there any significant difference between operating time of two brands of mobile?

Hypothesis:

Null hypothesis $H0:\mu1=\mu2$ i.e. there is no significant difference between operating time of different brands of mobile.

Alternative hypothesis $H1:\mu1\neq\mu2$ i.e. there is significant difference between operating time of different brands of mobile.

Level of significance:

Alpha= 5%

Test statistics:

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	5.588889	5.722222
Variance	0.881111	1.341944
Observations	9	9
Pooled Variance	1.111528	
Hypothesized Mean Difference	0	
df	16	
t Stat	-0.26828	
P(T<=t) one-tail	0.395957	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.791914	
t Critical two-tail	2.119905	

Decision:

Tcal<Ttab so, we accept H0

Hence, we conclude that there is no significant difference between operating time of different brands of mobile.

Lab no.4

- The reaction time of two different brands of drug of two group of patient is given below:

Group A	10	14	8	16	13	
Group B	11	9	12	17	14	16

At alpha = 5%, test whether two brands of drugs are equally efficient.

Hypothesis:

Null hypothesis H0:$\mu 1=\mu 2$ i.e. both brands are equally efficient.

Alternative hypothesis H1:$\mu 1\neq\mu 2$ i.e. both brands aren't equally efficient.

Alpha= 5%

Test statistics:

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	12.2	13.16667
Variance	10.2	9.366667
Observations	5	6
Pooled Variance	9.737037	
Hypothesized Mean Difference	0	
df	9	
t Stat	-0.5116	
P(T<=t) one-tail	0.310624	
t Critical one-tail	1.833113	
P(T<=t) two-tail	0.621248	
t Critical two-tail	2.262157	

Decision

Since Tcal<Ttab so we accept H0

Hence, we conclude that both brands of drugs are equally efficient.

Lab no. 5(paired t test)

- The marks obtained by 8 students in two attempts is given below:

student	1	2	3	4	5	6	7	8
First attempt	50	25	44	45	30	38	55	60
Second attempt	52	23	46	50	27	41	56	66

At 5% level of significance can you conclude that there is no significance difference between score of students in two attempts.

Hypothesis:

Null hypothesis H0: $\mu 1=\mu 2$ i.e. there is no significant difference between score of students in two attempt.

Alternative hypothesis H1: $\mu 1\neq\mu 2$ i.e. there is significant difference between score of students in two attempt.

Level of significance, alpha = 5%

Test statistics:

t-Test: Paired Two Sample for Means

	Variable 1	*Variable 2*
Mean	43.375	45.125
Variance	143.4107143	208.6964
Observations	8	8
Pearson Correlation	0.989776148	
Hypothesized Mean Difference	0	
df	7	
t Stat	1.593970119	
P(T<=t) one-tail	0.077485852	
t Critical one-tail	1.894578605	
P(T<=t) two-tail	0.154971704	
t Critical two-tail	2.364624252	

Decision

Here, Tcal<Ttab, so we accept H0**.** Hence we conclude that there is no significant difference between score of students in two attempt.

Lab no.6

- ❖ The performance score of employee before and after training is given below:

Employee	A	B	C	D	E	F
Before	6	7	6	11	16	12
After	9	8	4	15	21	13

At alpha= 5%, test whether the training is effective or not.

Hypothesis:

Null hypothesis H0: $\mu 1=\mu 2$ i.e. the training isn't effective.

Alternative hypothesis H1: $\mu 2>\mu 1$ i.e. the training is effective.

Alpha = 5%

Test statistics:

t-Test: Paired Two Sample for Means

	Variable 1	*Variable 2*
Mean	9.666666667	11.66667
Variance	16.26666667	35.86667
Observations	6	6
Pearson Correlation	0.946690609	
Hypothesized Mean Difference	0	
df	5	
t Stat	-1.936491673	
P(T<=t) one-tail	0.055283345	
t Critical one-tail	2.015048373	
P(T<=t) two-tail	0.110566691	
t Critical two-tail	2.570581836	

Decision

Here, Tcal<Ttab, so we accept H0

i.e. We conclude that the training isn't effective.

Lab no.7 (Wilcoxon sign rank test)

- The performance score of students before and after training is given below:

before	44	48	70	65	35	55	48	52	65
after	43	52	73	62	39	54	56	53	67

At 5% level of significance test whether training is beneficial or not.

Hypothesis

Null hypothesis: Md1=Md2 i.e. training isn't beneficial
Alternative hypothesis: Md2>Md2 i.e. training is beneficial.

Level of significance
Alpha= 5%

Test statistics:

Ranks

		N	Mean Rank	Sum of Ranks
after - before	Negative Ranks	3[a]	3.17	9.50
	Positive Ranks	6[b]	5.92	35.50
	Ties	0[c]		
	Total	9		

a. after < before
b. after > before
c. after = before

Test Statistics[a]

	after - before
Z	-1.548[b]
Asymp. Sig. (2-tailed)	.122

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

Since, p_{val}>alpha so we accept H0**.** Hence we conclude that training isn't beneficial.

Lab No.8

- The following dataset represents the score of 7 students in two attempts.

Before	After
4	8
6	5
7	9
11	12
15	18
19	17
5	10

Use Wilcoxon sign rank test to test whether there is significant difference between score of students in two attempts.

Solution:

Hypothesis

H0:Md1=Md2 i.e. there is no significance difference between score of students in 2 attempts.

H1: Md1≠ Md2 i.e. there is significance difference between score of students in 2 attempts.

Level of significance

Alpha= 5%

Critical value:

Ranks

		N	Mean Rank	Sum of Ranks
after - before	Negative Ranks	2[a]	2.50	5.00
	Positive Ranks	5[b]	4.60	23.00
	Ties	0[c]		
	Total	7		

a. after < before

b. after > before

c. after = before

Test Statistics[a]

	after - before
Z	-1.527^{b}
Asymp. Sig. (2-tailed)	.127

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Since P_{val}>alpha so we accept H0.

Hence we conclude that there is no significance difference between score of students in two attem

Lab no. 9 (Mann Whitney U test)

The following dataset represent the age of male and female employee of certain company.

Age of male	36	48	25	33	22	40	35
Age of female	20	28	35	42	46	25	29

At 5% level of significant test whether there is significance difference between age of male and female employee. Use man Whitney U test.

Solution:

Hypothesis:

H0:Md1=Md2 i.e. there is no significant difference between age of male and female.

H1: Md1≠ Md2 i.e. there is significant difference between age of male and female.

Level of significance

Alpha= 5%

Test statistics:

Ranks

	group	N	Mean Rank	Sum of Ranks
age	male	7	8.00	56.00
	female	7	7.00	49.00
	Total	14		

Test Statistics[a]

	age
Mann-Whitney U	21.000
Wilcoxon W	49.000
Z	-.448
Asymp. Sig. (2-tailed)	.654
Exact Sig. [2*(1-tailed Sig.)]	.710[b]

a. Grouping Variable: group

b. Not corrected for ties.

Since, P_{val} >alpha so we accept H0. Hence we conclude that there is no significant difference between age of male and female employee.

Lab No.10

- ❖ The following datasets represents the problem solving time of two groups of students.

Group I	Group II
12	16
20	10
16	18
22	24
30	19
11	21
39	40

At 5% level of significance, test whether the problem solving time of two group of student is similar. Use Mann- Whitney U test.

Solution:

Hypothesis

H0:Md1=Md2 i.e. the problem solving time is similar

H1: Md1≠Md2 i.e. the problem solving time isn't similar.

Level of significance

Alpha= 5%

Test statistics:

Ranks

	group	N	Mean Rank	Sum of Ranks
time	group I	7	7.50	52.50
	group II	7	7.50	52.50
	Total	14		

Test Statistics[a]

	time
Mann-Whitney U	24.500
Wilcoxon W	52.500
Z	.000
Asymp. Sig. (2-tailed)	1.000
Exact Sig. [2*(1-tailed Sig.)]	1.000[b]

a. Grouping Variable: group

b. Not corrected for ties.

Here P_{val}>alpha so we accept H0

Hence we conclude that the problem solving time is similar.

Lab no. 11

- ❖ The marks obtained by 2 groups of student is given below:

Group a	44	46	60	50	66	52	35	62	
Group b	50	53	40	51	62	63	54	48	

At 5% level of significance test whether there is significant difference between marks of two groups of student use median test

Hypothesis:

H0: md1=md2 i.e. there is no significant difference between marks of two group of students.

H1: md1≠md2 i.e. there is significant difference between marks of two group of students.

Alpha = 5%

Test statistics:

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The medians of marks are the same across categories of group.	Independent-Samples Median Test	1.000[1,2]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

[2]Fisher Exact Sig.

Decision

Hence we accept h0.

i.e. There is no significant difference between marks of two group of students.

lab no. 12

- The following data represents output of two different treatments.

Treatment 1	Treatment 2
46	56
65	40
48	52
55	61
70	72
47	64

At alpha =5%, test whether output of two different treatment are similar. Use median test.

Hypothesis:
H0: Md1=Md2 i.e. the output of two treatments are similar.
H1: Md1≠Md2 i.e. the output of two treatments aren’t similar.

Alpha = 5%

Test statistics:

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The medians of output are the same across categories of treatment.	Independent-Samples Median Test	.567[1,2]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

[2]Fisher Exact Sig.

Decision
Here we accept h0,
We conclude that the output of two treatments are similar.

Lab no 13

- The following table represents the operating time of 3 different brands of scientific calculator.

A	B	C
4.8	3.8	3.9
5.9	4.0	5.0
6.4	5.9	6.2
5.0	6.1	5.2
4.4	4.7	5.7
	7.0	

At 5% level of significance test whether there is significance difference between operating time of 3 different brands of calculator using kruskal wallis H test.

Hypothesis:
H0: There is no significance difference between operating time of 3 brands.
H1: There is significance difference between operating time of 3 brands.

Alpha = 5%

Test statistics:

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of operating_time is the same across categories of calculator.	Independent-Samples Kruskal-Wallis Test	.982	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hence we conclude that There is no significance difference between operating time of 3 brands.

Lab no 14:

- In an experiment to determine which of 3 different missile system is preferable, the propellent burning rate is measured. The data after coding are given in the table. Use Kruskal wallis test significace level of 0.01 to test the hypothesis that the propellent burning rates are same for the three missiles system.

Missile system A	Missile system B	Missile system c
22.3	23.4	18.4
16.7	19.5	19.5
22.7	17.5	17.8
19.3	20.8	18.0
18.5	16.0	19.6
	19.9	22.8
		17.1

Hypothesis:
H0: the propellent burning rates are same for the three missiles system.
H1: the propellent burning rates aren't same for the three missiles system.

Alpha =5%

Test statistics:

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of rate is the same across categories of missile.	Independent-Samples Kruskal-Wallis Test	.862	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Conclusion:
Here we accept h0 i.e. the propellent burning rates are same for the three missiles system.

Lab no 15(Regression):

- A computer manager needs to know how the efficiency of her new computer program depends on the size of incoming data and how many tables are used to arrange each data set. Efficiency will be measured by the number of processed requests per hour. Applying the program to data sets of different sizes and number of tables, she gets the following results.

Processed requests Y	Data size, (GB), X_1	Number of tables, X_2
16	15	1
26	10	10
41	8	10
50	7	20
55	7	20
40	6	4

A. Write the regression equation for the processed request.
B. Interpret the parameters of the regression model.
C. What percentage of variation on processed requests is explained by two independent variables?
D. Compute the standard error of the estimate.
E. Also compute adjusted R square.
F. Test the significance of each of the regression coefficients.
G. Test the overall goodness of fit of the model.

Solution

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.954350535
R Square	0.910784943
Adjusted R Square	0.851308238
Standard Error	5.651459145
Observations	6

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	978.1830286	489.0915143	15.31330537	0.026647547
Residual	3	95.8169714	31.93899047		
Total	5	1074			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	51.56781896	11.44130651	4.507161739	0.020403002	15.15647532
X Variable 1	-2.627727391	0.931963619	-2.819560054	0.066762648	-5.593651566
X Variable 2	0.890194431	0.390179791	2.281498046	0.106787936	-0.351531803

Let the regression equation be : Y=a+b1x1+b2x2

From the coefficient table,

a. Y=51.56-2.62x1+0.89x2 which is a required equation.

b. Here,
 a= 51.56 i.e. if x1 and x2 become zero then efficiency becomes 51.56.
 b1=-2.62 i.e. if we increase the data size by one unit then efficiency decreases by 2.62 units keeping the effect of several tables as constant.
 B2=0.89 i.e. if we increase the number of tables by one unit then efficiency increases by 0.89 keeping the effect of data size constant.

c. R2 = 0.91 i.e. 91% of total variation on processed requests is explained by two independent variables.

d. Standard error = 5.65 i.e. the average deviation of observation from the fitted regression line is 5.65.

e. Adjusted R2= 0.85

f. Test for B1,
 Hypothesis:
 H0: The regression coefficient isn't significant.
 H1: The regression coefficient is significant.

 Alpha = 5%

 Test statistics:
 T=2.81
 P value =0.066
 The decision, since the p-value is greater than alpha so we don't reject H0.
 Hence, we conclude that the regression coefficient is not significant.

 Test for B2,
 Hypothesis:
 H0: The regression coefficient isn't significant.
 H1: The regression coefficient is significant.

 Alpha = 5%

 Test statistics:
 T=2.28
 P value =0.01
 Decision, since the p value is less than alpha we reject H0.
 Hence, we conclude that the regression coefficient is significant.

g. Test for regression model

Hypothesis:
H0: The regression model isn’t significant.
H1: regression model is significant.

Alpha = 5%

Test statistics:
F =15.31
P value =0.026
The decision, since the p value is greater than alpha so we reject H0.
Hence, we conclude that the regression model is significant.

Lab no. 16

- It was reported somewhere that children whenever playing the game on computer, they use the computer very roughly which may reduce the lifetime of a computer. The random access memory (RAM) of a computer also plays a crucial role in the lifetime of a computer. A researcher wanted to examine how the lifetime of a personal computer that is used by children is affected by the time (in hours) spent by the children per day playing games and the available random access memory (RAM) measured in megabytes (MB) of a used computer. The data is provided in the following table.

Lifetime(years)	Play time(hours)/day	RAM in Mb
5	2	8
1	8	2
7	1	6
2	5	3
3	6	2
4	3	4
6	2	7

A. Write the estimated regression equation for the lifetime.
B. Interpret the parameters of the regression model.
C. What percentage of variation in lifetime is explained by two independent variables?
D. Compute the standard error of the estimate.
E. Also compute adjusted R square.
F. Test the significance of each of the regression coefficients.
G. Test the overall goodness of fit of the model.

Solution:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.939861914
R Square	0.883340416
Adjusted R Square	0.825010625
Standard Error	0.903668681
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	24.73353166	12.36676583	15.143898	0.013609458
Residual	4	3.266468338	0.816617085		
Total	6	28			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	6.961325967	2.481625648	2.805147493	0.048556218	0.071228582
X Variable 1	-0.785380365	0.29455627	-2.666316917	0.056020402	-1.603199679
X Variable 2	0.014874628	0.307243511	0.048413156	0.963707852	-0.838170114

Let the regression equation be: Y=a+b1x1+b2x2
From the coefficient table,

A. Y= 6.91 – 0.78x1+0.01x2.

B. Here a= 6.91 i.e. the lifetime will be 6.91 if we keep both independent variables zero
B1=-0.78 i.e. if we increase the value of playtime by one unit then the lifetime will be decreased by 0.78 keeping the effect of RAM constant
B2= 0.01 i.e. if we increase the value of RAM by one unit then the lifetime will be increased by 0.01 keeping the effect of play time constant.

C. R Square = 0.88 i.e. 88% of total deviation on lifetime is explained by two independent variables.

D. Standard error = 0.90 i.e. the average deviation from the fitting regression line is 0.90.

E. Adjusted R square = 0.82

F. Test for B1,
Hypothesis:
H0: The regression coefficient isn't significant.
H1: The regression coefficient is significant.

Alpha = 5%

Test statistics:
T=2.66
P value =0.056
The decision, since the p-value is greater than alpha so we don't reject H0.
Hence, we conclude that the regression coefficient is not significant.

Test for B2,
Hypothesis:
H0: The regression coefficient isn't significant.
H1: The regression coefficient is significant.

Alpha = 5%

Test statistics:
T=0.04
P value =0.96
The decision, since the p-value is greater than the alpha so we accept H0.
Hence, we conclude that the regression coefficient isn't significant.

G. Test for regression model

Hypothesis:

H0: The regression model isn't significant.
H1: The regression model is significant.

Alpha = 5%

Test statistics:
F =15.14
P value =0.01
The decision, since the p-value is smaller than alpha we don't reject H0.
Hence, we conclude that the regression model isn't significant.

Lab No. 17

❖ The Following table represents the layout of CRD of four treatments.

A (9)	B (14)	D (11)	C (10)
D (8)	A (14)	B (13)	C (16)
B (7)	C (12)	D (5)	A (11)
A (14)	B (12)	C (6)	D (5)

At 5% level of significance test whether there is significant difference between mean of 4 treatments.

Solution:

Hypothesis:

H_0: There is no significant difference between treatment.

H_1: There is significant difference between treatment.

Alpha = 5%

Test statistics:

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
A	4	48	12	6
B	4	46	11.5	9.666667
C	4	44	11	17.33333
D	4	39	9.75	18.25

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups(treatment)	11.1875	3	3.729167	0.291057	0.831069	3.490295
ERROR	153.75	12	12.8125			
Total	164.9375	15				

Decision,

Since $F_{cal} < F_{tab}$ so we accept H_0.

Hence we conclude that there is no significance difference between mean of 4 treatments.

Lab no 18

- There are three brands of computers namely dell, Lenovo, and HP. The following are the lifetime of 15 computers in years.

Serial Number	Computer Brand	Lifetime in Years
1	Dell	15
2	Lenovo	10
3	HP	9
4	Dell	12
5	Lenovo	6
6	HP	7
7	Dell	4
8	Lenovo	8
9	HP	13
10	Dell	11
11	HP	5
12	Lenovo	7
13	Dell	3
14	HP	5
15	Lenovo	4

Apply appropriate statistical tests to identify whether the average lifetime (in years) is significantly different across three brands of computers at a 5% level of significance. You can again tabulate the data initially in the required format for statistical analysis.

Hypothesis:

H_0: There is no significance difference among average lifetime of three brands of computers.

H_1: There is significance difference among average lifetime of three brands of computers.

Alpha = 5%

Test statistics:

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Row 1	5	45	9	27.5
Row 2	5	35	7	5
Row 3	5	39	7.8	11.2

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F c*
Between Groups	10.13333333	2	5.066666667	0.347826087	0.713111407	3.88

ERROR	174.8	12	14.56666667
Total	184.9333333	14	

Decision,

$F_{cal} < f_{tab}$, so we accept H_0,

Hence we conclude that There is no significance difference among average lifetime of three brands of computers.

Lab no. 19

- The following table represents the layout of R.B.D of 4 treatments (fertilizers) which is measured under 4 different conditions.

Conditions

Treatments	I	II	III	IV
A	16	19	18	10
B	11	17	15	9
C	8	19	11	17
D	10	15	8	18

Carry out the analysis of the design.

Hypothesis:

H_{0T}: There is no significance difference between treatments.

H_{1T}: There is significance difference between treatments.

H_{0B} : There is no significant difference between blocks.

H_{1B} : There is significant difference between blocks.

Level of significance,

Alpha = 5%

Test statistics:

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
A	4	63	15.75	16.25
B	4	52	13	13.33333
C	4	55	13.75	26.25
D	4	51	12.75	20.91667
1	4	45	11.25	11.58333
2	4	70	17.5	3.666667
3	4	52	13	19.33333

4	4	54	13.5	21.66667

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
treatment	22.1875	3	7.395833	0.454158	0.720775	3.862548
Block	83.6875	3	27.89583	1.713006	0.233458	3.862548
Error	146.5625	9	16.28472			
Total	252.4375	15				

Decision:

Since in both cases, $f_{cal} < f_{tab}$, so we accept H_0

i.e. There is no significance difference between treatments and blocks.

Lab no. 20

- The following table gives the result of the experiment on four varieties of a crop in 5 blocks of plot.

Block I	Block II	Block III	Block IV	Block V
A 32	B 33	D 30	A 35	C 36
B 34	C 34	C 35	C 32	D 29
C 31	A 34	B 36	B 37	A 37
D 29	D 26	A 33	D 28	B 35

Analyse the above result to test whether there is significant difference between yields of four varieties and also test whether blocks are homogenous or not.

Hypothesis:

H_{0T} : There is no significant difference between treatments.

H_{1T} : There is significant difference between treatments.

H_{0B} : There is no significant difference between blocks.

H_{1B} : There is significant difference between blocks.

Level of significance:

α=5%

Test statistics:

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
A	5	171	34.2	3.7
B	5	175	35	2.5
C	5	168	33.6	4.3
D	5	148	29.6	11.3
I	4	126	31.5	4.333333
II	4	127	31.75	14.91667
III	4	134	33.5	7

IV	4	132	33	15.33333
V	4	143	35.75	0.916667

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
treatments	86.6	3	28.86667	8.469438	0.00272	3.490295
Blocks	46.3	4	11.575	3.396088	0.044567	3.259167
Error	40.9	12	3.408333			
Total	173.8	19				

Decision:

In both cases, $f_{cal} > f_{tab}$, so we reject H_0

Hence we conclude that there is significant difference between treatments and blocks.