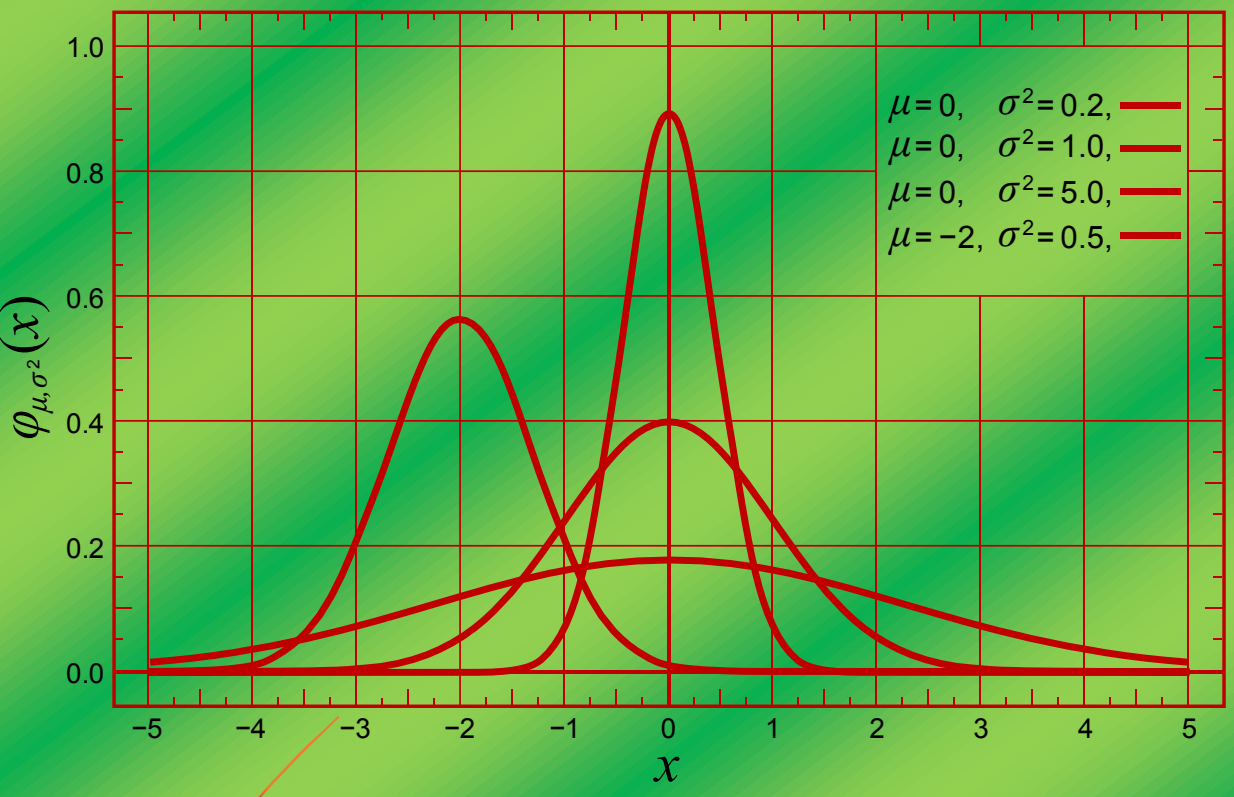
SPSS Practical Manual on Completely Randomized Design (CRD)



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Example:

The following table gives the yields in pound per plot, of five varieties of wheat after being applied to each of 4 plots, tested in a Completely Randomized Design. Carry out the Completely Randomized Design for data.

Treatments	Repetitions			
A	8	8	6	10
B	10	12	13	9
C	18	17	13	16
D	12	10	15	11
E	8	11	9	8

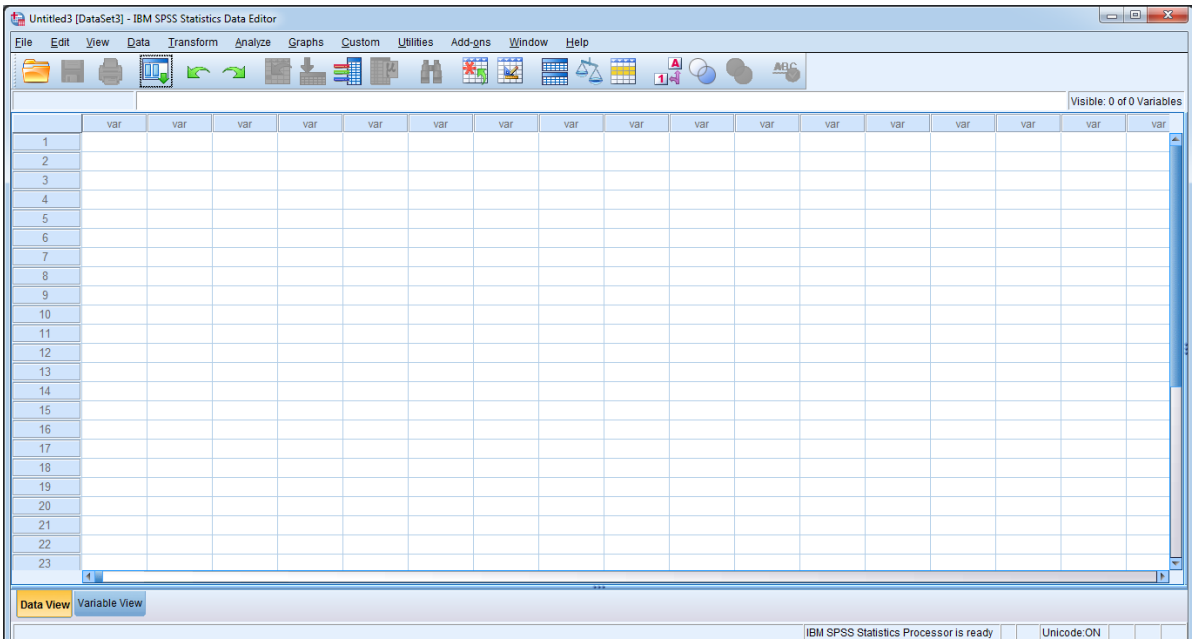
Arragment of Data for Analysis:

Treatment	Yield
1	8
2	10
3	18
4	12
5	8
1	8
2	12
3	17
4	10
5	11
1	6
2	13
3	13
4	15
5	9
1	10
2	9
3	16
4	11
5	8

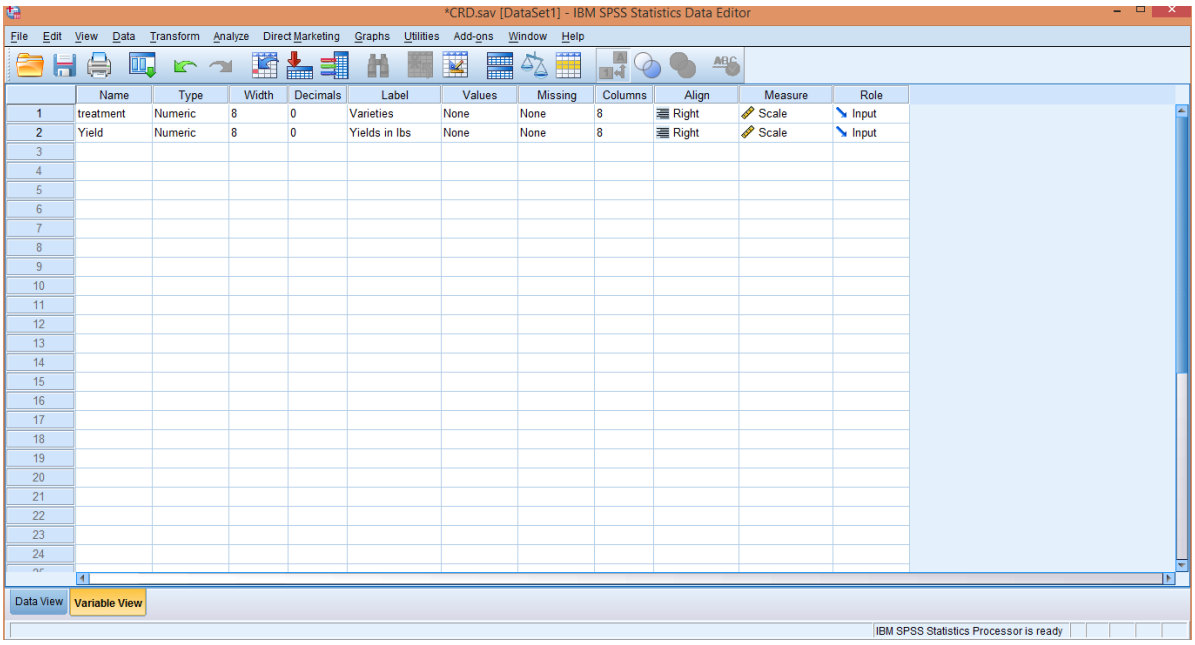
SPSS commands for Analysis:

The input data file can be created as shown below:

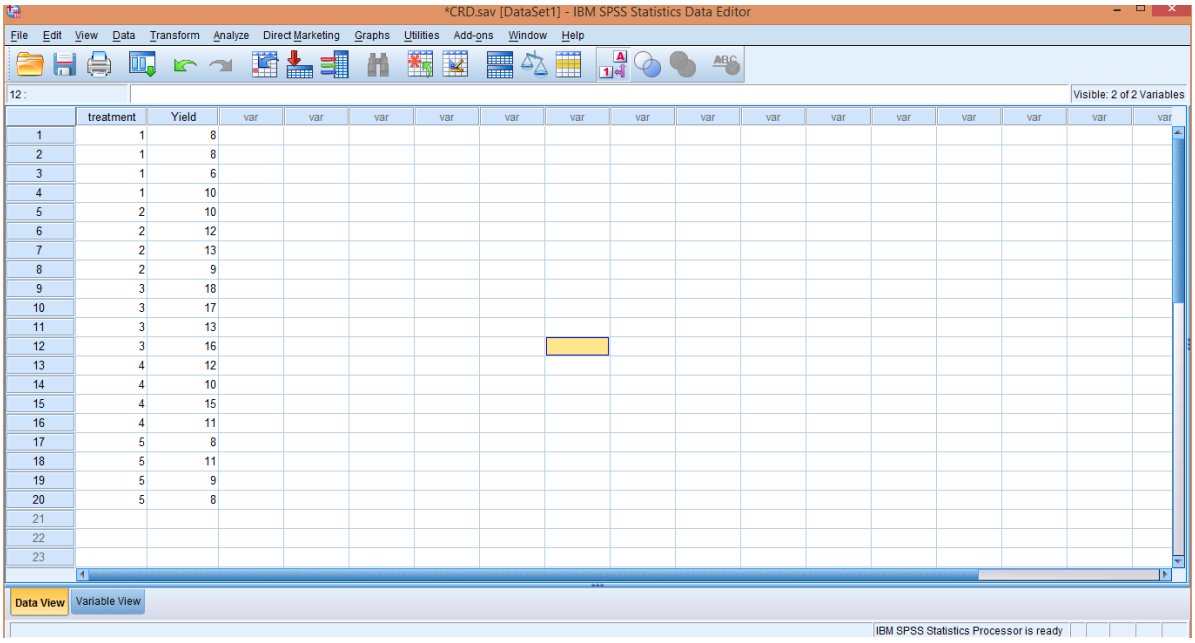
Step 1: File → New → Data →



Step 2: Variable view → Name (treatment, yield) →

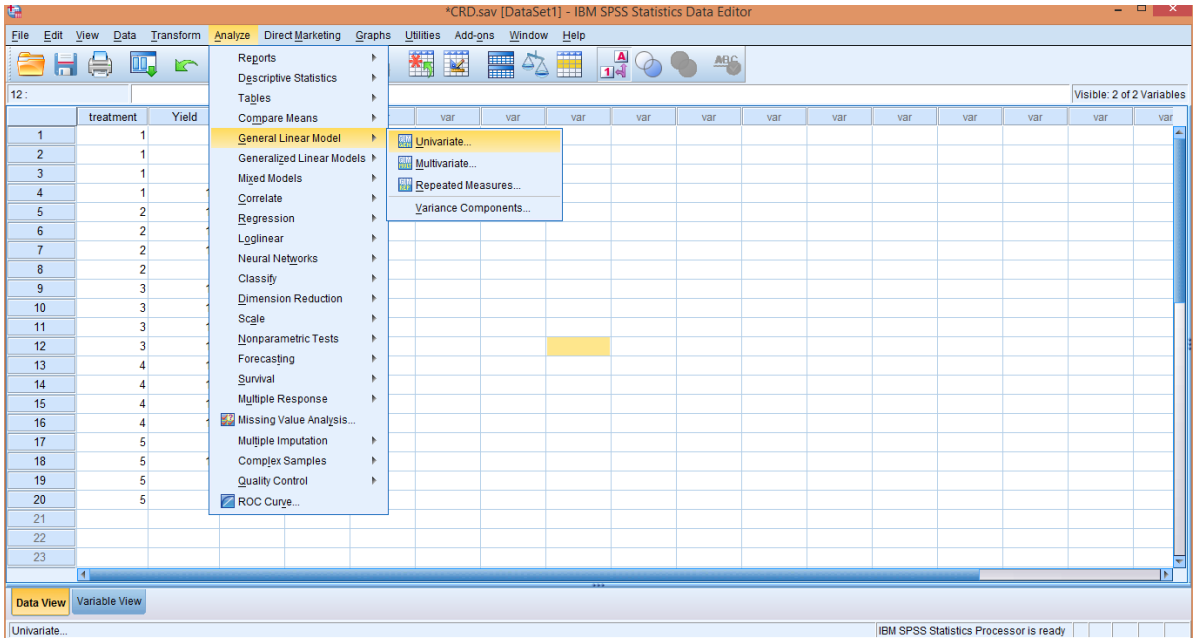


Step 3: Data view → Enter data → File → Save (with any file name)

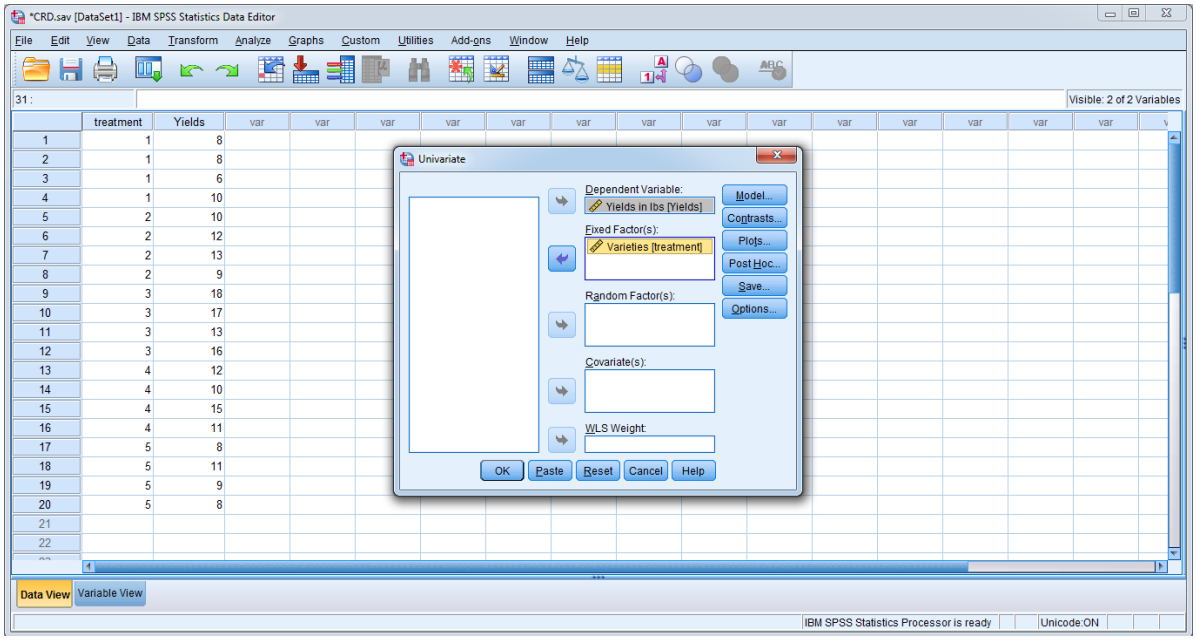


	treatment	Yield
1	1	8
2	1	8
3	1	6
4	1	10
5	2	10
6	2	12
7	2	13
8	2	9
9	3	18
10	3	17
11	3	13
12	3	16
13	4	12
14	4	10
15	4	15
16	4	11
17	5	8
18	5	11
19	5	9
20	5	8
21		
22		
23		

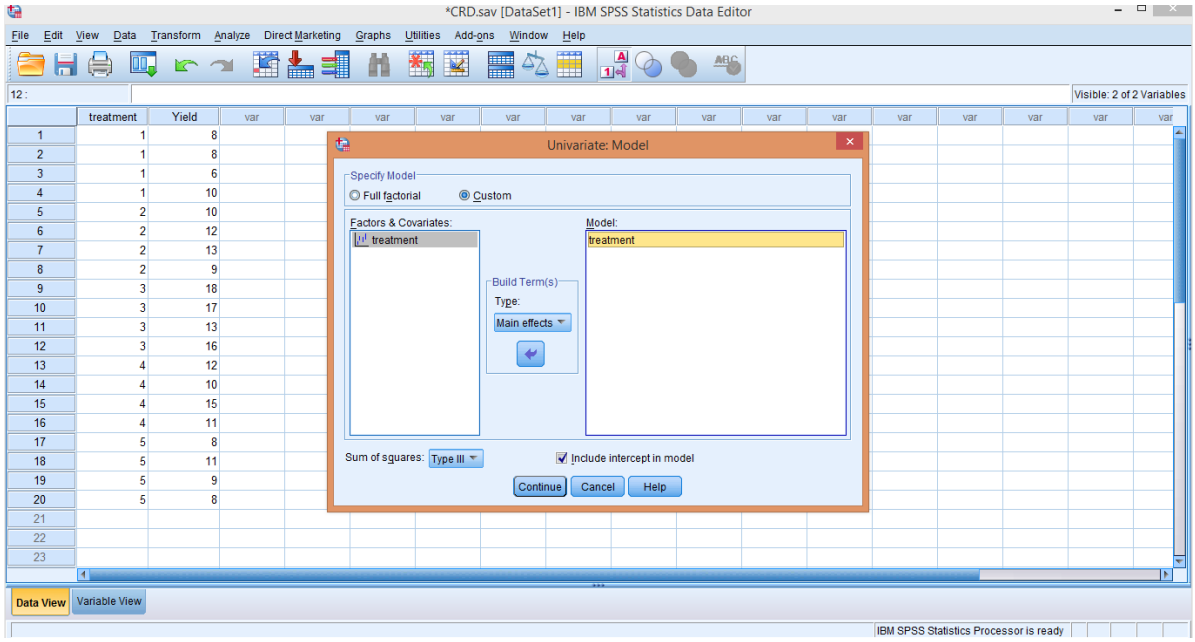
Step 4: Analyze → General Linear Model → Univariate →



Step 5: Dependent variable (yield) → Fixed factors (treatment)



Step 6: Model → Custom → Main effects → Build terms (treat) → Sum of Squares (Type III) → Continue



Linear model - $y_{ij} = \mu + a_i + \varepsilon_{ij}$; $(i=1, 2, \ldots, k; j=1, 2, \ldots, r)$

Yield = μ + Treatment + ε_{ij}

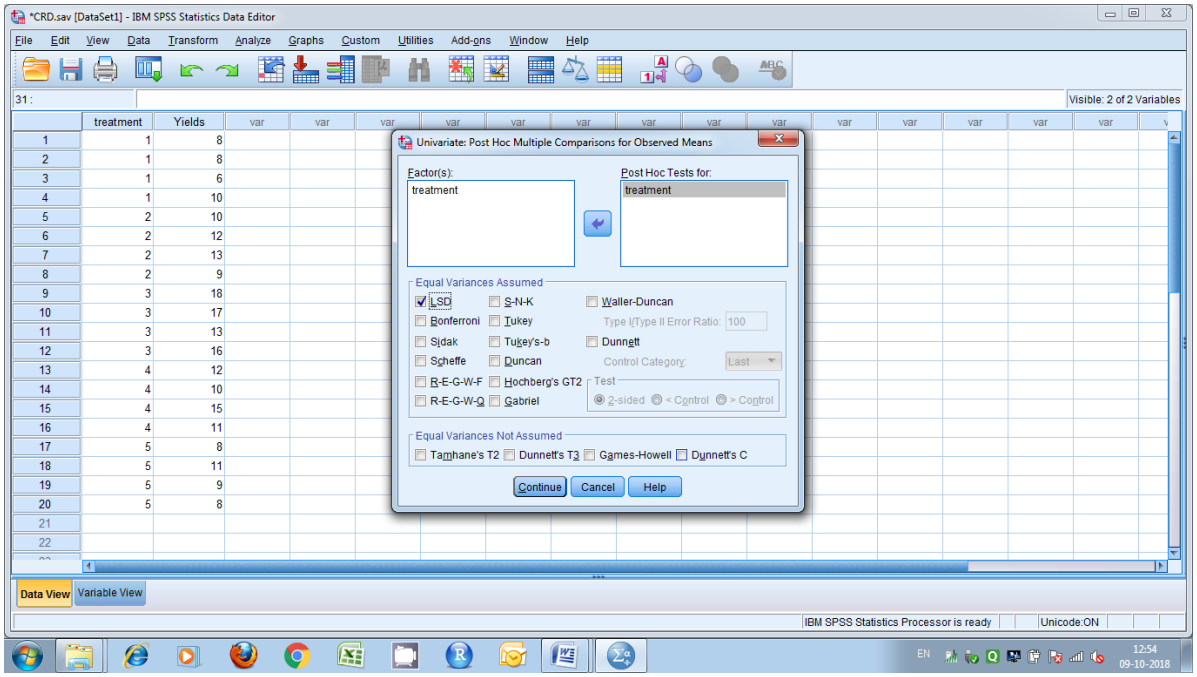
where y_{ij} = Response of the j^{th} replication and i^{th} treatment

μ = general mean effect

a_i = i^{th} treatment effect

ε_{ij} = error effect with mean=0 and variance = σ^2 [N(0, σ^2)]

Step 7: → Posthoc → Posthoc Tests for (treatment) → LSD → OK



Output:

ANOVA –Treatments

Tests of Between-Subjects Effects

Dependent Variable: Yields in lbs

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	155.200[a]	4	38.800	11.192	.000
Intercept	2508.800	1	2508.800	723.692	.000
treatment	155.200	4	38.800	11.192**	.000
Error	52.000	15	3.467		
Total	2716.000	20			
Corrected Total	207.200	19			

a. R Squared = .749 (Adjusted R Squared = .682)

** Significant at 1% level of significance

Yields in lbs

Varieties	Mean	N	Std. Deviation
1	8.00	4	1.633
2	11.00	4	1.826
3	16.00	4	2.160
4	12.00	4	2.160
5	9.00	4	1.414
Total	11.20	20	3.302

POSTHOC TESTS – Treatments

Multiple Comparisons

Dependent Variable: Yields in lbs

LSD

(I) Varieties	(J) Varieties	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	-3.00*	1.317	.038	-5.81	-.19
	3	-8.00*	1.317	.000	-10.81	-5.19
	4	-4.00*	1.317	.008	-6.81	-1.19
	5	-1.00	1.317	.459	-3.81	1.81
2	1	3.00*	1.317	.038	.19	5.81
	3	-5.00*	1.317	.002	-7.81	-2.19
	4	-1.00	1.317	.459	-3.81	1.81
	5	2.00	1.317	.150	-.81	4.81
3	1	8.00*	1.317	.000	5.19	10.81
	2	5.00*	1.317	.002	2.19	7.81
	4	4.00*	1.317	.008	1.19	6.81
	5	7.00*	1.317	.000	4.19	9.81
4	1	4.00*	1.317	.008	1.19	6.81
	2	1.00	1.317	.459	-1.81	3.81
	3	-4.00*	1.317	.008	-6.81	-1.19
	5	3.00*	1.317	.038	.19	5.81
5	1	1.00	1.317	.459	-1.81	3.81
	2	-2.00	1.317	.150	-4.81	.81
	3	-7.00*	1.317	.000	-9.81	-4.19
	4	-3.00*	1.317	.038	-5.81	-.19

Yields in lbs

	Varieties	N	Subset			
			1	2	3	4
Duncan[a,b]	1[d]	4	8.00			
	5[cd]	4	9.00	9.00		
	2[bc]	4		11.00	11.00	
	4[b]	4			12.00	
	3[a]	4				16.00
	Sig.		.459	.150	.459	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 3.467.

a. Uses Harmonic Mean Sample Size = 4.000.

b. Alpha = 0.05.

Do Yourself

The following table gives the yields in pound per plot of five varieties of wheat after being applied to each of 4 plots, tested in a completely randomized design. Carry out the completely randomized design for data.

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A	8	8	6	10
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Reference Books:

1. A Hand Book of Agricultural Statistics, S. R. S. Chandel, Achal Prakashan Mandir, Kanpur.
2. A Text book of Agricultural Statistics, R. Rangaswamy, New Age International (P) Limited, publishers.
3. Biometrical Methods in Quantitative Genetic Analysis, R.K. Singh and B. D. Chaudhary, Kalyani Publishers.
4. Design Resources Server: www.iasri.res.in
5. E-Manual Winter School IASRI.
6. Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor, Sultan Chand & Sons Educational Publications.
7. Fundamentals Applied Statistics, S.C. Gupta and V.K. Kapoor, Sultan Chand & Sons Educational Publications.

8. Programmed Statistics, B.L. Agarwal, New Age International (P) Limited, publishers.
9. Probability and Statistical Inference: Theory and Practice, D. Bhattacharya and S. Roy Chowdhury, U. N. Dhur & Sons.
10. Statistics Theory and Practice, D. Bhattacharya and S. Roy Chowdhury, U. N. Dhur & Sons.
11. Statistical Methods, K.P. Dhamu and K. Ramamoorthy, AGROBIOS (INDIA).
12. Statistics for Agricultural Sciences, G. Nageswara Rao, Second Edition, BS Publications, Hyderabad.