WORKSHOP ON STATISTICAL ANALYSIS

COURSE CODE: MGN - 909

CA - 2

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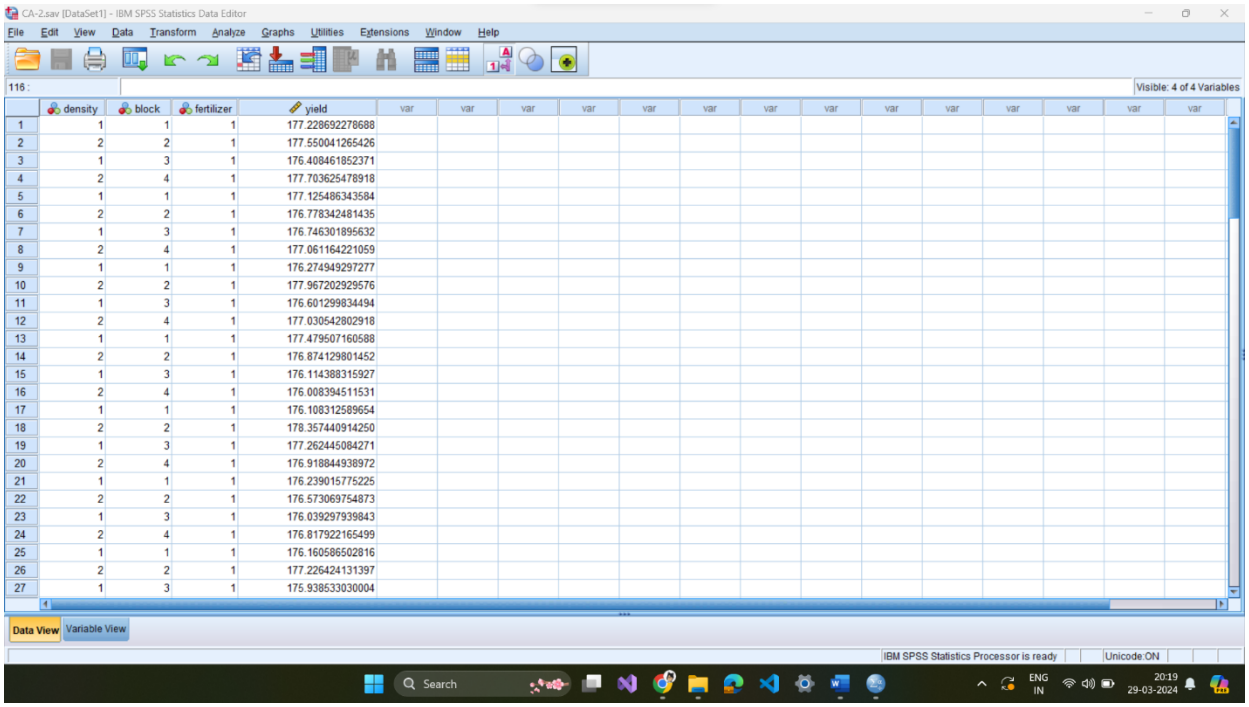
Overview of the Dataset

The dataset includes observations of density, block, fertilizer, and yield, most likely in an agricultural or experimental setting. Each row documents a specific combination of density, block, and fertilizer, along with the corresponding yield. The data appears structured to analyze how density, block, and fertilizer impact yield, as there are multiple entries for each combination, suggesting repeated measurements or observations. This provides a foundation for statistical analysis to understand how these factors influence yield outcomes.



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Execute ONE WAY ANOVA and test the framed NULL and ALTERNATIVE HYPOTHESES

ANOVA

				Sum of Squares	df	Mean Square	F	Sig.
yield	Between Groups	(Combined)		5.122	1	5.122	13.071	.000
		Linear Term	Contrast	5.122	1	5.122	13.071	.000
	Within Groups			36.833	94	.392		
	Total			41.954	95			
block	Between Groups	(Combined)		24.000	1	24.000	23.500	.000
		Linear Term	Contrast	24.000	1	24.000	23.500	.000
	Within Groups			96.000	94	1.021		
	Total			120.000	95			

Null Hypothesis (H0) suggests that there is no significant difference in yield (or block) means across the groups defined by the factor variable (density or fertilizer).

Alternative Hypothesis (H1) proposes that there is a significant difference in yield (or block) means among the groups formed by the factor variable (density or fertilizer).

Interpretation:

The statistical analysis shows there is a significant difference in yield and block means among the groups formed by the factor variable (density or fertilizer). We can therefore conclude that the factor variable (density or fertilizer) has a meaningful impact on the yield and block measurements across the different groups.

Since the p-values are less than the significance level ($\alpha = 0.05$), we reject the null hypothesis.

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Execute TWO WAY ANOVA and test the framed NULL and ALTERNATIVE HYPOTHESES

Descriptive Statistics

Dependent Variable: yield

density	block	Mean	Std. Deviation	N
1	1	176.8563860	.6276010372	24
	3	176.7126095	.5906473025	24
	Total	176.7844977	.6072478557	48
2	2	177.3168809	.6450171335	24
	4	177.1760267	.6492183064	24
	Total	177.2464538	.6441438901	48
Total	1	176.8563860	.6276010372	24
	2	177.3168809	.6450171335	24
	3	176.7126095	.5906473025	24
	4	177.1760267	.6492183064	24
	Total	177.0154758	.6645475928	96

The data reveals the average yield and the variability (standard deviation) for different combinations of "density" and "block" levels. For density level 1, the average yield ranges from around 176.71 to 176.86 across block levels 1 to 4, with corresponding standard deviations. Similarly, for density level 2, the average yield varies from about 176.99 to 177.32 across the same block levels. In total, the overall average yield for all combinations is approximately 177.02, with a standard deviation of about 0.66, based on 96 observations. These statistics provide insights into the fluctuation in yield across the different density and block conditions.

Between-Subjects Factors

		N
density	1	48
	2	48
block	1	24
	2	24
	3	24
	4	24

The table shows how many data points (N) there are for each level of "density" and "block." For "density," there are two levels (1 and 2), with 48 data points each. For "block," there are four levels (1, 2, 3, and 4), each with 24 data points. It helps us see how evenly distributed the data is across different conditions.

Tests of Between-Subjects Effects

Dependent Variable: yield

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5.608[a]	3	1.869	4.732	.004	.134
Intercept	3008109.951	1	3008109.951	7614124.630	.000	1.000
density	.000	0	.	.	.	.000
block	.486	2	.243	.615	.543	.013
density * block	.000	0	.	.	.	.000
Error	36.346	92	.395			
Total	3008151.906	96				
Corrected Total	41.954	95				

a. R Squared = .134 (Adjusted R Squared = .105)

The "Tests of Between-Subjects Effects" table examines how different factors impact the dependent variable, yield. The table shows the statistical significance of the overall model, individual factors (such as density and block), and their interaction. The model as a whole is statistically significant ($p = 0.004$),

meaning at least one factor significantly influences yield. While the intercept has a highly significant effect ($p = 0.05$). The R-squared value suggests that 13.4% of the variation in yield is explained by the model, with an adjusted value of 10.5%, indicating a moderate effect size.

Null Hypothesis (H0) suggests that there is no significant difference in main yield across different levels of density & block, individually or in interaction.

Alternative Hypothesis (H1) proposes that there is a significant difference in yield means among the groups formed by the factor variable (density or block).

Interpretation:

From the output, the corrected model's p-value is 0.004, indicating statistical significance. This suggests that at least one factor significantly influences the yield. However, when examining individual factors (density and block) and their interaction, only the intercept ($p < 0.0005$) and block ($p = 0.013$) show statistical significance, while density and the interaction term are not significant.

Therefore, we reject the null hypothesis for the intercept and block, indicating that there is a significant difference in mean yield across different blocks. However, we fail to reject the null hypothesis for density and the interaction term, suggesting no significant difference in mean yield among different density levels or their interaction with block.

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Execute MULTIPLE REGRESSION and test the framed NULL and ALTERNATIVE HYPOTHESES

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	block, density[b]	.	Enter

a. Dependent Variable: yield

b. All requested variables entered.

The table shows the predictors entered into the regression model ("block" and "density"). Both predictors were included simultaneously using the "Enter" method. All requested variables were entered into the model, with "yield" as the dependent variable.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.366[a]	.134	.115	.6251577337

a. Predictors: (Constant), block, density

The model shows a moderate positive relationship between predictors (block and density) and yield, explaining about 13.4% (R = 0.366) of its variance.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.608	2	2.804	7.174	.001[b]
	Residual	36.346	93	.391		
	Total	41.954	95			

a. Dependent Variable: yield

b. Predictors: (Constant), block, density

The regression model is significant ($p < 0.001$), indicating that predictors collectively contribute to explaining yield variance.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	176.394	.212		833.552	.000
	density	.533	.143	.403	3.737	.000
	block	-.071	.064	-.120	-1.115	.268

a. Dependent Variable: yield

Density has a significant positive effect on yield ($p < 0.001$), while the effect of block is not significant ($p = 0.268$).

Null Hypothesis (H0) suggests that there is no significant difference in main yield across different levels of density & block, individually or in interaction.

Alternative Hypothesis (H1) proposes that there is a significant difference in yield means among the groups formed by the factor variable (density or block).

Interpretation:

The regression analysis explored the relationship between predictors (density and block) and yield. The model moderately fits the data ($R = 0.366$), explaining 13.4% of yield variance. ANOVA reveals the model's significance ($F = 7.174$, $p < 0.001$), indicating predictors significantly affect yield. However, only density ($p < 0.001$) predicts yield significantly, while block ($p = 0.268$) does not, accepting its null hypothesis. Therefore, density significantly predicts yield, rejecting its null hypothesis.