

The problem arises when there are more than two groups and we want to identify the differences between them. We'll have to compare two groups at a time. So if we had 4 groups we would have to make 6 comparisons: A&B - A&C - A&D - B&C - B&D - C&D. Thus, the probability of error increases.

One Way Anova

A test to determine whether the mean of several independent sets of data is equal or not

Note that the previous t-test is conducted between two groups only

The idea of the variance test is that the groups represent one community, and therefore the total variance of the groups can be calculated once and the variance test once

Null hypothesis : Means equal (no differences)

Alternative hypothesis: Means are not equal (there are differences)

Example: The following data represent the scores of three groups of students in the Applied Criminal Statistics course, and it is required to determine whether the averages of the students' scores in the three groups are equal or not?

المجموعة الأولى G1	المجموعة الثانية G2	المجموعة الثالثة G3
75	80	70
77	82	72
79	84	74
81	86	76
83	88	78

Null Hypothesis

**The averages of the three groups are equal
(there is no difference)**

Alternative Hypothesis

**The averages of the three groups are not
equal (there is difference)**

IBM SPSS Statistics Data Editor window titled "Untitled1 [DataSet0]". The menu bar includes File, Edit, View, Data, Transform, Analyze, Direct Marketing, Graphs, Utilities, Add-ons, Window, and Help. The toolbar contains icons for file operations, data manipulation, and analysis.

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Groups	Numeric	8	2		None	None	8	Right	Nominal	Input
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
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22											
23											
24											
25											

The bottom status bar shows "Data View" and "Variable View" tabs, with "Variable View" selected. A message "Go to Settings to activate Windows." is displayed on the right. The status bar also indicates "IBM SPSS Statistics Processor is ready".

IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Groups	Numeric	8	2		... المجموعة, 1.0	None	8	Right	Nominal	Input
2	Grades	Numeric	8	2		None	None	8	Right	Scale	Input
3											
4											
5											
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7											
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17											
18											
19											
20											
21											
22											
23											
24											
25											

Value Labels

Value Labels

Value:

Label:

1.00 = "Group 1"

2.00 = "Group 2"

3.00 = "Group 3"

OK Cancel Help

Activate Windows

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

IBM SPSS Statistics Data Editor window showing the Variable View for a dataset named "Untitled1 [DataSet0]". The interface includes a menu bar (File, Edit, View, Data, Transform, Analyze, Direct Marketing, Graphs, Utilities, Add-ons, Window, Help) and a toolbar with various icons for file operations, data manipulation, and analysis.

The Variable View table displays the following columns: Name, Type, Width, Decimals, Label, Values, Missing, Columns, Align, Measure, and Role. Two variables are defined:

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Groups	Numeric	8	2		... المجموعة , 1.0	None	8	Right	Nominal	Input
2	Grades	Numeric	8	2		None	None	8	Right	Scale	Input
3											
4											
5											
6											
7											
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9											
10											
11											
12											
13											
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15											
16											
17											
18											
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24											
25											

The bottom status bar indicates "Data View" and "Variable View" tabs, with "Variable View" currently selected. A message at the bottom right states "Activate Windows. Go to Settings to activate Windows." and "IBM SPSS Statistics Processor is ready".

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 2 of 2 Variables

	Groups	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	.															
2	1.00	.															
3	1.00	.															
4	1.00	.															
5	1.00	.															
6																	
7																	
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15																	
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	

1

Data View Variable View

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

16 : Group

Visible: 2 of 2 Variables

	Groups	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	.															
2	1.00	.															
3	1.00	.															
4	1.00	.															
5	1.00	.															
6	2.00	.															
7	2.00	.															
8	2.00	.															
9	2.00	.															
10	2.00	.															
11	3.00	.															
12	3.00	.															
13	3.00	.															
14	3.00	.															
15	3.00	.															
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	

Data View Variable View

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 2 of 2 Variables

	Groups	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	75.00															
2	1.00	77.00															
3	1.00	79.00															
4	1.00	81.00															
5	1.00	83.00															
6	2.00																
7	2.00	.															
8	2.00	.															
9	2.00	.															
10	2.00	.															
11	3.00	.															
12	3.00	.															
13	3.00	.															
14	3.00	.															
15	3.00	.															
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	

Data View Variable View

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

15 : Grades 78.00 Visible: 2 of 2 Variables

	Groups	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	75.00															
2	1.00	77.00															
3	1.00	79.00															
4	1.00	81.00															
5	1.00	83.00															
6	2.00	80.00															
7	2.00	82.00															
8	2.00	84.00															
9	2.00	86.00															
10	2.00	88.00															
11	3.00	70.00															
12	3.00	72.00															
13	3.00	74.00															
14	3.00	76.00															
15	3.00	78.00															
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	

Data View Variable View

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform **Analyze** Direct Marketing Graphs Utilities Add-ons Window Help

15 : Grades 78.00

Visible: 2 of 2 Variables

	Groups	Grades
1	1.00	76.0
2	1.00	77.0
3	1.00	79.0
4	1.00	81.0
5	1.00	83.0
6	2.00	80.0
7	2.00	82.0
8	2.00	84.0
9	2.00	86.0
10	2.00	88.0
11	3.00	70.0
12	3.00	72.0
13	3.00	74.0
14	3.00	76.0
15	3.00	78.0
16		
17		
18		
19		
20		
21		
22		
23		

Reports
Descriptive Statistics
Tables
Compare Means
General Linear Model
Generalized Linear Models
Mixed Models
Correlate
Regression
Loglinear
Neural Networks
Classify
Dimension Reduction
Scale
Nonparametric Tests
Forecasting
Survival
Multiple Response
Missing Value Analysis...
Multiple Imputation
Complex Samples
Quality Control
ROC Curve...

Means...
One-Sample T Test...
Independent-Samples T Test...
Paired-Samples T Test...
One-Way ANOVA...

Data View Variable View

One-Way ANOVA... IBM SPSS Statistics Processor is ready

Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

15 : Grades 78.00 Visible: 2 of 2 Variables

	Groups	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	75.00														
2	1.00	77.00														
3	1.00	79.00														
4	1.00	81.00														
5	1.00	83.00														
6	2.00	80.00														
7	2.00	82.00														
8	2.00	84.00														
9	2.00	86.00														
10	2.00	88.00														
11	3.00	70.00														
12	3.00	72.00														
13	3.00	74.00														
14	3.00	76.00														
15	3.00	78.00														
16																
17																
18																
19																
20																
21																
22																
23																

One-Way ANOVA

Groups
Grades

Dependent List:

Factor:

OK Paste Reset Cancel Help

Contrasts...
Post Hoc...
Options...
Bootstrap...

Data View Variable View

IBM SPSS Statistics Processor is ready

IBM SPSS Statistics Data Editor window showing a dataset with 23 rows and 18 columns. The first two columns are 'Groups' and 'Grades'. The 'Grades' column contains values ranging from 70.00 to 88.00. A 'One-Way ANOVA' dialog box is open, showing 'Groups' as the factor and 'Grades' as the dependent variable. The dialog box has buttons for 'Contrasts...', 'Post Hoc...', 'Options...', and 'Bootstrap...'. The 'OK' button is highlighted.

	Groups	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	75.00															
2	1.00	77.00															
3	1.00	79.00															
4	1.00	81.00															
5	1.00	83.00															
6	2.00	80.00															
7	2.00	82.00															
8	2.00	84.00															
9	2.00	86.00															
10	2.00	88.00															
11	3.00	70.00															
12	3.00	72.00															
13	3.00	74.00															
14	3.00	76.00															
15	3.00	78.00															
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	

One-Way ANOVA dialog box:

- Factor: Groups
- Dependent List: Grades
- Buttons: Contrasts..., Post Hoc..., Options..., Bootstrap...
- Buttons: OK, Paste, Reset, Cancel, Help

SPSS One-Way ANOVA dialog box configuration:

- Dependent List: Grades
- Factor: Groups
- Buttons: Post Hoc... (highlighted), Contrasts..., Options..., Bootstrap...

Background data table (Visible: 2 of 2 Variables):

	Groups	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	75.00														
2	1.00	77.00														
3	1.00	79.00														
4	1.00	81.00														
5	1.00	83.00														
6	2.00	80.00														
7	2.00	82.00														
8	2.00	84.00														
9	2.00	86.00														
10	2.00	88.00														
11	3.00	70.00														
12	3.00	72.00														
13	3.00	74.00														
14	3.00	76.00														
15	3.00	78.00														
16																
17																
18																
19																
20																
21																
22																
23																

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

15: Grades 78.00 Visible: 2 of 2 Variables

	Groups	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	75.00															
2	1.00	77.00															
3	1.00	79.00															
4	1.00	81.00															
5	1.00	83.00															
6	2.00	80.00															
7	2.00	82.00															
8	2.00	84.00															
9	2.00	86.00															
10	2.00	88.00															
11	3.00	70.00															
12	3.00	72.00															
13	3.00	74.00															
14	3.00	76.00															
15	3.00	78.00															
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	

One-Way ANOVA: Post Hoc Multiple Comparisons

Equal Variances Assumed

- ☐ LSD
- ☐ Bonferroni
- ☐ Sidak
- ☐ Scheffe
- ☐ R-E-G-W F
- ☐ R-E-G-W Q
- ☒ Tukey
- ☐ SNK
- ☐ Tukey's b
- ☐ Duncan
- ☐ Hochberg's GT2
- ☐ Gabriel
- ☐ Waller-Duncan
- Type I/Type II Error Ratio: 100
- ☐ Dunnett
- Control Category: Last
- Test: ☒ 2-sided ☐ < Control ☐ > Control

Equal Variances Not Assumed

- ☐ Tamhane's T2
- ☐ Dunnett's T3
- ☐ Games-Howell
- ☐ Dunnett's C

Significance level: 0.05

Continue Cancel Help

Data View Variable View

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

IBM SPSS Statistics Data Editor window showing a dataset named "Untitled1 [DataSet0]". The dataset has two variables: "Groups" and "Grades". The "Grades" variable is highlighted in yellow, and its value for the selected row (15) is 78.00.

The "One-Way ANOVA: Post Hoc Multiple Comparisons" dialog box is open, showing the "Equal Variances Assumed" section. The "Tukey" option is selected under "Equal Variances Assumed". The "Significance level" is set to 0.05. The "Continue" button is highlighted with a red rectangle.

The "Data View" tab is active, showing the following data:

Groups	Grades
1.00	75.00
1.00	77.00
1.00	79.00
1.00	81.00
1.00	83.00
2.00	80.00
2.00	82.00
2.00	84.00
2.00	86.00
2.00	88.00
3.00	70.00
3.00	72.00
3.00	74.00
3.00	76.00
3.00	78.00

*Output1 [Document1] - IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Output

- Log
- Oneway
 - Title
 - Notes
 - Active Dataset
 - ANOVA
 - Post Hoc Tests
 - Title
 - Multiple Comparisons
 - Homogeneous
 - Title
 - Grades

➔ **Oneway**

[DataSet01]

ANOVA

Grades

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	250.000	2	125.000	12.500	.001
Within Groups	120.000	12	10.000		
Total	370.000	14			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Grades

	(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Group 1	Group 2	-5.00000	2.00000	.067	-10.3357	.3357
		Group 3	5.00000	2.00000	.067	-.3357	10.3357
	Group 2	Group 1	5.00000	2.00000	.067	-.3357	10.3357
		Group 3	10.00000*	2.00000	.001	4.6643	15.3357
	Group 3	Group 1	-5.00000	2.00000	.067	-10.3357	.3357
		Group 2	-10.00000*	2.00000	.001	-15.3357	-4.6643
Dunnett T3	Group 1	Group 2	-5.00000	2.00000	.099	-10.9160	.9160
		Group 3	5.00000	2.00000	.099	-.9160	10.9160
		Group 2	Group 1	5.00000	2.00000	.099	-.9160

Activate Windows
Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

ANOVA

Grades

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	250.000	2	125.000	12.500	.001
Within Groups	120.000	12	10.000		
Total	370.000	14			

Statistical decision

The resulting probabilistic value of 0.001 is less than 0.05 (the level of significance), so we reject the null hypothesis that the average scores for the three groups are equal, and we accept the alternative hypothesis that the average scores of the three groups are unequal

Post Hoc tests

It remains to determine which of the groups results in statistical differences that are significant, in other words, which groups are the reason for the existence of the differences Tukey Test

Multiple Comparisons

			Mean Difference (I- J)	Std. Error	Sig.	95% Confidence Interval	
(I) Groups	(J) Groups	Lower Bound				Upper Bound	
Tukey HSD	Group 1	Group 2	-5.00000	2.00000	.067	-10.3357	.3357
		Group 3	5.00000	2.00000	.067	-.3357	10.3357
	Group 2	Group 1	5.00000	2.00000	.067	-.3357	10.3357
		Group 3	10.00000*	2.00000	.001	4.6643	15.3357
	Group 3	Group 1	-5.00000	2.00000	.067	-10.3357	.3357
		Group 2	-10.00000*	2.00000	.001	-15.3357	-4.6643
Dunnnett T3	Group 1	Group 2	-5.00000	2.00000	.099	-10.9160	.9160
		Group 3	5.00000	2.00000	.099	-.9160	10.9160
	Group 2	Group 1	5.00000	2.00000	.099	-.9160	10.9160
		Group 3	10.00000*	2.00000	.003	4.0840	15.9160
	Group 3	Group 1	-5.00000	2.00000	.099	-10.9160	.9160
		Group 2	-10.00000*	2.00000	.003	-15.9160	-4.0840

Homogeneous Subsets

Grades			
Groups	N	Subset for alpha = 0.05	
		1	2

IBM SPSS Statistics Processor is ready

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Grades

		Mean Difference (I- J)	Std. Error	Sig.	95% Confidence Interval	
(I) Groups	(J) Groups				Lower Bound	Upper Bound
Tukey HSD	Group 1	-5.00000	2.00000	.067	-10.3357	.3357
	Group 3	5.00000	2.00000	.067	-.3357	10.3357
	Group 2	5.00000	2.00000	.067	-.3357	10.3357
	Group 3	10.00000*	2.00000	.001	4.6643	15.3357
	Group 1	-5.00000	2.00000	.067	-10.3357	.3357
	Group 2	-10.00000*	2.00000	.001	-15.3357	-4.6643

Statistical decision

Looking at the results of the post-tests, we find that the resulting probabilistic value between the second group and the third group is 0.001 which is less than 0.05 (the level of significance), so we say that there are statistically significant differences between the second group and the third group, and that the differences between the rest of the groups are not statistically significant.

Nationality			Education level			
Egyptian	1		1	Less than Secondary		
Arab	2		2	Secondary		
foreigners	3		3	Graduate		
			4	Postgraduate		
Gender						
1	Male				City	
2	Female			1	Cairo	
				2	Alex	
				3	Aswan	
				4	Hurghada	

X1				X2			
1	Strongly Disagree			1	Strongly Disagree		
2	Disagree			2	Disagree		
3	Not Sure			3	Not Sure		
4	Agree			4	Agree		
5	Strongly Agree			5	Strongly Agree		
X1		Satisfication with place		X2		Satisfication with services	
X4				X3			
1	Strongly Disagree			1	Strongly Disagree		
2	Disagree			2	Disagree		
3	Not Sure			3	Not Sure		
4	Agree			4	Agree		
5	Strongly Agree			5	Strongly Agree		
X4	performance satisfaction			X3	Satisfaction with the employees		

Number	City	Gender	Education level	Nationality	X1	X2	X3	X4	
1	1	1	1	3	1	5	4	2	2
2	2	3	2	2	1	3	3	3	3
3	3	2	2	1	1	5	4	4	4
4	4	1	2	1	2	4	5	5	1
5	5	2	1	2	1	5	5	5	2
6	6	1	1	2	3	4	4	2	1
7	7	1	2	3	1	5	5	4	2
8	8	4	1	2	2	4	2	2	5
9	9	1	2	4	1	3	5	3	5
10	10	2	1	3	1	5	4	5	2
11	11	1	1	2	1	1	5	2	2
12	12	2	2	1	2	2	2	2	2
13	13	1	2	2	1	4	2	2	2
14	14	2	2	2	3	5	3	3	3
15	15	1	1	2	2	3	2	2	2
16	16	3	1	1	1	4	1	1	1
17	17	3	2	4	3	5	1	5	5
18	18	1	2	1	2	5	5	4	4
19	19	2	1	1	3	3	3	5	5
20	20	1	2	1	2	3	3	5	4
21	21	3	1	3	1	5	5	5	2
22	22	2	1	4	1	4	4	2	1
23	23	1	2	3	1	5	5	4	2
24	24	4	1	4	2	4	2	2	5
25	25	2	2	2	1	3	5	3	5
26	26	3	1	3	2	5	4	5	2
27	27	1	2	4	1	1	5	2	2
28	28	1	2	2	3	5	1	2	4
29	29	2	1	3	1	5	3	5	5
30	30	3	1	4	2	5	3	3	2

Study hypotheses test

- 1- There are no statistically significant differences at the significance level (0.05) between Satisfaction with place according to the variable (City - Gender - Educational level - Nationality).
- 2- There are no statistically significant differences at the significance level (0.05) between Satisfaction with services according to the variable (City - Gender - Educational level - Nationality).
- 3- There are no statistically significant differences at the significance level (0.05) between Performance Satisfaction according to the variable (City - Gender - Educational level - Nationality).
- 4- There are no statistically significant differences at the significance level (0.05) between Satisfaction with employees according to the variable (City - Gender - Educational level - Nationality).

Anova Total2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

29 : q4 1.00 Visible: 7 of 7 Variables

	q1	q2	q3	q4	x1	x2	x3	var	var	var	var	var	var	var	var	var
1	1.00	1.00	4.00	1.00	5.00	4.00	2.00									
2	2.00	2.00	2.00	1.00	3.00	3.00	3.00									
3	1.00	2.00	1.00	1.00	5.00	4.00	4.00									
4	2.00	2.00	1.00	2.00	5.00	5.00	5.00									
5	1.00	1.00	2.00	1.00	1.00	5.00	5.00									
6	1.00	1.00	4.00	3.00	4.00	4.00	4.00									
7	1.00	2.00	4.00	1.00	4.00	4.00	4.00									
8	1.00	1.00	4.00	2.00	4.00	3.00	4.00									
9	1.00	2.00	4.00	1.00	5.00	5.00	5.00									
10	2.00	1.00	3.00	1.00	4.00	2.00	4.00									
11	1.00	2.00	2.00	1.00	2.00	2.00	2.00									
12	2.00	2.00	1.00	2.00	2.00	2.00	2.00									
13	1.00	1.00	1.00	3.00	2.00	2.00	2.00									
14	2.00	1.00	2.00	1.00	3.00	5.00	3.00									
15	1.00	1.00	2.00	3.00	3.00	5.00	3.00									
16	3.00	1.00	3.00	1.00	4.00	4.00	5.00									
17	2.00	1.00	4.00	3.00	5.00	5.00	5.00									
18	2.00	1.00	1.00	1.00	5.00	5.00	4.00									
19	2.00	1.00	1.00	2.00	2.00	4.00	5.00									
20	1.00	2.00	2.00	2.00	3.00	3.00	3.00									
21	4.00	2.00	1.00	3.00	3.00	2.00	3.00									
22	1.00	1.00	4.00	2.00	4.00	4.00	3.00									
23	2.00	1.00	1.00	3.00	5.00	3.00	5.00									

1

Data View Variable View

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

Anova Total2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform **Analyze** Direct Marketing Graphs Utilities Add-ons Window Help

29 : q4 1.00

Visible: 7 of 7 Variables

q1 q2

1 1.00 1.00

2 2.00 2.00

3 1.00 2.00

4 2.00 2.00

5 1.00 1.00

6 1.00 1.00

7 1.00 2.00

8 1.00 1.00

9 1.00 2.00

10 2.00 1.00

11 1.00 2.00

12 2.00 2.00

13 1.00 1.00

14 2.00 1.00

15 1.00 1.00

16 3.00 1.00

17 2.00 1.00

18 2.00 1.00

19 2.00 1.00

20 1.00 2.00

21 4.00 2.00

22 1.00 1.00

23 2.00 1.00

1.00 3.00

4.00 2.00

4.00 4.00

4.00 3.00

5.00 5.00

4.00 2.00

2.00 2.00

2.00 2.00

2.00 2.00

3.00 5.00

3.00 5.00

4.00 4.00

5.00 5.00

5.00 5.00

2.00 4.00

3.00 3.00

3.00 2.00

4.00 4.00

5.00 3.00

1 Means...

2 One-Sample T Test...

3 Independent-Samples T Test...

4 Paired-Samples T Test...

5 One-Way ANOVA...

6 General Linear Model

7 Generalized Linear Models

8 Mixed Models

9 Correlate

10 Regression

11 Loglinear

12 Neural Networks

13 Classify

14 Dimension Reduction

15 Scale

16 Nonparametric Tests

17 Forecasting

18 Survival

19 Multiple Response

20 Missing Value Analysis...

21 Multiple Imputation

22 Complex Samples

23 Quality Control

24 ROC Curve...

Data View Variable View

One-Way ANOVA...

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

IBM SPSS Statistics Data Editor window showing a dataset with 29 rows and 18 columns. The columns are labeled Q1, Q2, Q3, Q4, X1, X2, X3, X4, and seven unlabeled 'var' columns. The data is displayed in a grid view.

The 'One-Way ANOVA' dialog box is open, showing the 'Dependent List' and 'Factor' fields. The 'Dependent List' contains the following variables:

- Nationality [Q1]
- Gender [Q2]
- Education Level [Q3]
- City [Q4]
- Satisfaction with pl...
- Satisfaction with se...
- Performance satisfi...
- Satisfaction with e...

The 'Factor' field is empty. The 'Contrasts...', 'Post Hoc...', 'Options...', and 'Bootstrap...' buttons are visible on the right side of the dialog box.

The taskbar at the bottom shows the Windows operating system with various application icons and a system clock indicating 1:31 PM on 6/23/2021.

IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 8 of 8 Variables

	Q1	Q2	Q3	Q4	X1	X2	X3	X4	var	var	var	var	var	var	var	var	var	var
1	1.00	1.00	3.00	1.00	5.00	4.00	2.00	2.00										
2	1.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00										
3	1.00	2.00	1.00	2.00	5.00	4.00	4.00	4.00										
4	2.00	2.00	1.00	1.00	4.00	5.00	5.00	1.00										
5	1.00	1.00	2.00	2.00	5.00	5.00	5.00	2.00										
6	3.00	1.00	2.00	1.00	4.00	4.00	2.00	1.00										
7	1.00	2.00	3.00	1.00	5.00	5.00	4.00	2.00										
8	2.00	1.00	2.00	4.00	4.00	2.00												
9	1.00	2.00	4.00	1.00	3.00	5.00												
10	1.00	1.00	3.00	2.00	5.00	4.00												
11	1.00	1.00	2.00	1.00	1.00	5.00												
12	2.00	2.00	1.00	2.00	2.00	2.00												
13	1.00	2.00	2.00	1.00	4.00	2.00												
14	3.00	2.00	2.00	2.00	5.00	3.00												
15	2.00	1.00	2.00	1.00	3.00	2.00												
16	1.00	1.00	1.00	3.00	4.00	1.00												
17	3.00	2.00	4.00	3.00	5.00	1.00												
18	2.00	2.00	1.00	1.00	5.00	5.00												
19	3.00	1.00	1.00	2.00	3.00	3.00												
20	2.00	2.00	1.00	1.00	3.00	3.00	5.00	4.00										
21	1.00	1.00	3.00	3.00	5.00	5.00	5.00	2.00										
22	1.00	1.00	4.00	2.00	4.00	4.00	2.00	1.00										
23	1.00	2.00	3.00	1.00	5.00	5.00	4.00	2.00										
24	2.00	1.00	4.00	4.00	4.00	2.00	2.00	5.00										
25	1.00	2.00	2.00	2.00	3.00	5.00	3.00	5.00										
26	2.00	1.00	3.00	3.00	5.00	4.00	5.00	2.00										
27	1.00	2.00	4.00	1.00	1.00	5.00	2.00	2.00										
28	3.00	2.00	2.00	1.00	5.00	1.00	2.00	4.00										
29	1.00	1.00	3.00	2.00	5.00	3.00	5.00	5.00										

One-Way ANOVA

Dependent List

- Nationality [Q1]
- Education Level [Q3]
- City [Q4]

Factor:

- Gender [Q2]

Contrasts... Post Hoc... Options... Bootstrap

OK Paste Reset Cancel Help

Independent Variable

Data View Variable View

IBM SPSS Statistics Processor is ready.

Type here to search

33°C Sunny 2:03 PM 6/23/2021

IBM SPSS Statistics Data Editor window showing a dataset with 29 rows and 18 columns. The columns are labeled Q1, Q2, Q3, Q4, X1, X2, X3, X4, var, var, var, var, var, var, var, var, var, var. The data is as follows:

	Q1	Q2	Q3	Q4	X1	X2	X3	X4	var	var	var	var	var	var	var	var	var	var
1	1.00	1.00	3.00	1.00	5.00	4.00	2.00	2.00										
2	1.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00										
3	1.00	2.00	1.00	2.00	5.00	4.00	4.00	4.00										
4	2.00	2.00	1.00	1.00	4.00	5.00	5.00	1.00										
5	1.00	1.00	2.00	2.00	5.00	5.00	5.00	2.00										
6	3.00	1.00	2.00	1.00	4.00	4.00	2.00	1.00										
7	1.00	2.00	3.00	1.00	5.00	5.00	4.00	2.00										
8	2.00	1.00	2.00	4.00	4.00	2.00												
9	1.00	2.00	4.00	1.00	3.00	5.00												
10	1.00	1.00	3.00	2.00	5.00	4.00												
11	1.00	1.00	2.00	1.00	1.00	5.00												
12	2.00	2.00	1.00	2.00	2.00	2.00												
13	1.00	2.00	2.00	1.00	4.00	2.00												
14	3.00	2.00	2.00	2.00	5.00	3.00												
15	2.00	1.00	2.00	1.00	3.00	2.00												
16	1.00	1.00	1.00	3.00	4.00	1.00												
17	3.00	2.00	4.00	3.00	5.00	1.00												
18	2.00	2.00	1.00	1.00	5.00	5.00												
19	3.00	1.00	1.00	2.00	3.00	3.00												
20	2.00	2.00	1.00	1.00	3.00	3.00	5.00	4.00										
21	1.00	1.00	3.00	3.00	5.00	5.00	5.00	2.00										
22	1.00	1.00	4.00	2.00	4.00	4.00	2.00	1.00										
23	1.00	2.00	3.00	1.00	5.00	5.00	4.00	2.00										
24	2.00	1.00	4.00	4.00	4.00	2.00	2.00	5.00										
25	1.00	2.00	2.00	2.00	3.00	5.00	3.00	5.00										
26	2.00	1.00	3.00	3.00	5.00	4.00	5.00	2.00										
27	1.00	2.00	4.00	1.00	1.00	5.00	2.00	2.00										
28	3.00	2.00	2.00	1.00	5.00	1.00	2.00	4.00										
29	1.00	1.00	3.00	2.00	5.00	3.00	5.00	5.00										

The 'One-Way ANOVA' dialog box is open, showing the following settings:

- Dependent List:** Satisfaction with pl..., Satisfaction with se..., Performance satisf..., Satisfaction with e...
- Factor:** Nationality [Q1]
- Gender [Q2]** is selected in the list of factors.
- Education Level [Q3]** is selected in the list of factors.
- City [Q4]** is selected in the list of factors.

The 'Data View' tab is selected at the bottom of the window.

IBM SPSS Statistics Data Editor window showing a dataset with 29 rows and 18 columns. The columns are labeled Q1, Q2, Q3, Q4, X1, X2, X3, X4, and eight 'var' columns. The data is as follows:

	Q1	Q2	Q3	Q4	X1	X2	X3	X4	var	var	var	var	var	var	var	var	var
1	1.00	1.00	3.00	1.00	5.00	4.00	2.00	2.00									
2	1.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00									
3	1.00	2.00	1.00	2.00	5.00	4.00	4.00	4.00									
4	2.00	2.00	1.00	1.00	4.00	5.00	5.00	1.00									
5	1.00	1.00	2.00	2.00	5.00	5.00	5.00	2.00									
6	3.00	1.00	2.00	1.00	4.00	4.00	2.00	1.00									
7	1.00	2.00	3.00	1.00	5.00	5.00	4.00	2.00									
8	2.00	1.00	2.00	4.00	4.00	2.00											
9	1.00	2.00	2.00	4.00	1.00	3.00	5.00										
10	1.00	1.00	3.00	2.00	5.00	4.00											
11	1.00	1.00	2.00	1.00	1.00	5.00											
12	2.00	2.00	1.00	2.00	2.00	2.00											
13	1.00	2.00	2.00	2.00	1.00	4.00	2.00										
14	3.00	2.00	2.00	2.00	5.00	3.00											
15	2.00	1.00	2.00	1.00	3.00	2.00											
16	1.00	1.00	1.00	3.00	4.00	1.00											
17	3.00	2.00	2.00	4.00	3.00	5.00	1.00										
18	2.00	2.00	1.00	1.00	5.00	5.00											
19	3.00	1.00	1.00	2.00	3.00	3.00											
20	2.00	2.00	1.00	1.00	3.00	3.00	5.00	4.00									
21	1.00	1.00	3.00	3.00	5.00	5.00	5.00	2.00									
22	1.00	1.00	4.00	2.00	4.00	4.00	2.00	1.00									
23	1.00	2.00	3.00	1.00	5.00	5.00	4.00	2.00									
24	2.00	1.00	4.00	4.00	4.00	2.00	2.00	5.00									
25	1.00	2.00	2.00	2.00	3.00	5.00	3.00	5.00									
26	2.00	1.00	3.00	3.00	5.00	4.00	5.00	2.00									
27	1.00	2.00	4.00	1.00	1.00	5.00	2.00	2.00									
28	3.00	2.00	2.00	1.00	5.00	1.00	2.00	4.00									
29	1.00	1.00	3.00	2.00	5.00	3.00	5.00	5.00									

The 'One-Way ANOVA' dialog box is open, showing 'Gender [Q2]' as the Factor and 'Satisfaction with pl...', 'Satisfaction with se...', 'Performance satisfi...', and 'Satisfaction with e...' as the Dependent List. A red box highlights the 'Independent Variable' label, and a red arrow points to the 'Gender [Q2]' factor.

Anova Total2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

29 : q4 1.00 Visible: 7 of 7 Variables

	q1	q2	q3	q4	x1	x2	x3	var	var	var	var	var	var	var	var	var
1	1.00	1.00	4.00	1.00	5.00	4.00	2.00									
2	2.00	2.00	2.00	1.00	3.00	3.00	3.00									
3	1.00	2.00	1.00	1.00												
4	2.00	2.00	1.00	2.00												
5	1.00	1.00	2.00	1.00												
6	1.00	1.00	4.00	3.00												
7	1.00	2.00	4.00	1.00												
8	1.00	1.00	4.00	2.00												
9	1.00	2.00	4.00	1.00												
10	2.00	1.00	3.00	1.00												
11	1.00	2.00	2.00	1.00												
12	2.00	2.00	1.00	2.00												
13	1.00	1.00	1.00	3.00												
14	2.00	1.00	2.00	1.00												
15	1.00	1.00	2.00	3.00												
16	3.00	1.00	3.00	1.00												
17	2.00	1.00	4.00	3.00												
18	2.00	1.00	1.00	1.00												
19	2.00	1.00	1.00	2.00	2.00	4.00	5.00									
20	1.00	2.00	2.00	2.00	3.00	3.00	3.00									
21	4.00	2.00	1.00	3.00	3.00	2.00	3.00									
22	1.00	1.00	4.00	2.00	4.00	4.00	3.00									
23	2.00	1.00	1.00	3.00	5.00	3.00	5.00									

One-Way ANOVA: Post Hoc Multiple Comparisons

Equal Variances Assumed

- ☐ LSD
- ☐ Bonferroni
- ☐ Sidak
- ☐ Scheffe
- ☐ R-E-G-W F
- ☐ R-E-G-W Q
- ☐ S-N-K
- ☒ Tukey
- ☐ Tukey's-b
- ☐ Duncan
- ☐ Hochberg's GT2
- ☐ Gabriel
- ☐ Waller-Duncan
- ☐ Dunnett

Type I/Type II Error Ratio: 100

Control Category: Last

Test

☒ 2-sided ☐ < Control ☐ > Control

Equal Variances Not Assumed

- ☐ Tamhane's T2
- ☐ Dunnett's T3
- ☐ Games-Howell
- ☐ Dunnett's C

Significance level: 0.05

Continue Cancel Help

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

Anova Total2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

29 : q4 1.00 Visible: 7 of 7 Variables

	q1	q2	q3	q4	x1	x2	x3	var	var	var	var	var	var	var	var	var	var
1	1.00	1.00	4.00	1.00	5.00	4.00	2.00										
2	2.00	2.00	2.00	1.00	3.00	3.00	3.00										
3	1.00	2.00	1.00	1.00													
4	2.00	2.00	1.00	2.00													
5	1.00	1.00	2.00	1.00													
6	1.00	1.00	4.00	3.00													
7	1.00	2.00	4.00	1.00													
8	1.00	1.00	4.00	2.00													
9	1.00	2.00	4.00	1.00													
10	2.00	1.00	3.00	1.00													
11	1.00	2.00	2.00	1.00													
12	2.00	2.00	1.00	2.00													
13	1.00	1.00	1.00	3.00													
14	2.00	1.00	2.00	1.00													
15	1.00	1.00	2.00	3.00													
16	3.00	1.00	3.00	1.00													
17	2.00	1.00	4.00	3.00													
18	2.00	1.00	1.00	1.00													
19	2.00	1.00	1.00	2.00	2.00	4.00	5.00										
20	1.00	2.00	2.00	2.00	3.00	3.00	3.00										
21	4.00	2.00	1.00	3.00	3.00	2.00	3.00										
22	1.00	1.00	4.00	2.00	4.00	4.00	3.00										
23	2.00	1.00	1.00	3.00	5.00	3.00	5.00										

One-Way ANOVA: Post Hoc Multiple Comparisons

Equal Variances Assumed

☐ LSD ☐ S-N-K ☐ Waller-Duncan
☐ Bonferroni ☒ Tukey Type I/Type II Error Ratio: 100
☐ Sidak ☐ Tukey's-b ☐ Dunnett
☐ Scheffe ☐ Duncan Control Category: Last
☐ R-E-G-W-F ☐ Hochberg's GT2
☐ R-E-G-W-Q ☐ Gabriel Test
☒ 2-sided ☐ < Control ☐ > Control

Equal Variances Not Assumed

☐ Tamhane's T2 ☐ Dunnett's T3 ☐ Games-Howell ☐ Dunnett's C

Significance level: 0.05

Continue Cancel Help

Data View Variable View

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Output

- Log
- Oneway
 - Title
 - Notes
 - Active Dataset
 - ANOVA
 - Post Hoc Tests
 - Title
 - Multiple Com
 - Homogeneous
 - Satisfica
 - Satisfica
 - Performa
 - Satisfica
- Log
- Oneway
 - Title
 - Notes
 - Active Dataset
 - Warnings
 - ANOVA

ONEWAY X1 X2 X3 X4 BY Q2
/MISSING ANALYSIS
/POSTHOC=DUKEY ALPHA(0.05).

➔ Oneway

[DataSet2] C:\Users\Dr.A1 Faisal\Documents\25-6-2021.sav

Warnings

Post hoc tests are not performed for Satisfaction with place because there are fewer than three groups.
Post hoc tests are not performed for Satisfaction with services because there are fewer than three groups.
Post hoc tests are not performed for Performance satisfaction because there are fewer than three groups.
Post hoc tests are not performed for Satisfaction with employees because there are fewer than three groups.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Satisfaction with place	Between Groups	.533	1	.533	.360	.553
	Within Groups	41.467	28	1.481		
	Total	42.000	29			
Satisfaction with services	Between Groups	.300	1	.300	.152	.699
	Within Groups	55.200	28	1.971		
	Total	55.500	29			
Performance satisfaction	Between Groups	.300	1	.300	.162	.691
	Within Groups	52.000	28	1.857		
	Total	52.300	29			
Satisfaction with employees	Between Groups	2.700	1	2.700	1.303	.263
	Within Groups	58.000	28	2.071		
	Total	60.700	29			

IBM SPSS Statistics Processor is ready

Type here to search

33°C Sunny 2:11 PM 6/23/2021

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Satisfaction with place	Between Groups	.533	1	.533	.360	.553
	Within Groups	41.467	28	1.481		
	Total	42.000	29			
Satisfaction with services	Between Groups	.300	1	.300	.152	.699
	Within Groups	55.200	28	1.971		
	Total	55.500	29			
Performance satisfaction	Between Groups	.300	1	.300	.162	.691
	Within Groups	52.000	28	1.857		
	Total	52.300	29			
Satisfaction with employees	Between Groups	2.700	1	2.700	1.303	.263
	Within Groups	58.000	28	2.071		
	Total	60.700	29			

Study hypotheses test

Gender

	Question	Significance	Statistical decision
1	Satisfaction with place	0.553	Not statistically significant
2	Satisfaction with services	0.699	Not statistically significant
3	Performance Satisfaction	0.691	Not statistically significant
4	Satisfaction with employees	0.263	Not statistically significant

IBM SPSS Statistics Data Editor window showing a dataset with 29 rows and 18 columns. The columns are labeled Q1, Q2, Q3, Q4, X1, X2, X3, X4, and seven 'var' columns. The data is as follows:

	Q1	Q2	Q3	Q4	X1	X2	X3	X4	var	var	var	var	var	var	var	var	var
1	1.00	1.00	3.00	1.00	5.00	4.00	2.00	2.00									
2	1.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00									
3	1.00	2.00	1.00	2.00	5.00	4.00	4.00	4.00									
4	2.00	2.00	1.00	1.00	4.00	5.00	5.00	1.00									
5	1.00	1.00	2.00	2.00	5.00	5.00	5.00	2.00									
6	3.00	1.00	2.00	1.00	4.00	4.00	2.00	1.00									
7	1.00	2.00	3.00	1.00	5.00	5.00	4.00	2.00									
8	2.00	1.00	2.00	4.00	4.00	2.00											
9	1.00	2.00	4.00	1.00	3.00	5.00											
10	1.00	1.00	3.00	2.00	5.00	4.00											
11	1.00	1.00	2.00	1.00	1.00	5.00											
12	2.00	2.00	1.00	2.00	2.00	2.00											
13	1.00	2.00	2.00	1.00	4.00	2.00											
14	3.00	2.00	2.00	2.00	5.00	3.00											
15	2.00	1.00	2.00	1.00	3.00	2.00											
16	1.00	1.00	1.00	3.00	4.00	1.00											
17	3.00	2.00	4.00	3.00	5.00	1.00											
18	2.00	2.00	1.00	1.00	5.00	5.00											
19	3.00	1.00	1.00	2.00	3.00	3.00											
20	2.00	2.00	1.00	1.00	3.00	3.00	5.00	4.00									
21	1.00	1.00	3.00	3.00	5.00	5.00	5.00	2.00									
22	1.00	1.00	4.00	2.00	4.00	4.00	2.00	1.00									
23	1.00	2.00	3.00	1.00	5.00	5.00	4.00	2.00									
24	2.00	1.00	4.00	4.00	4.00	2.00	2.00	5.00									
25	1.00	2.00	2.00	2.00	3.00	5.00	3.00	5.00									
26	2.00	1.00	3.00	3.00	5.00	4.00	5.00	2.00									
27	1.00	2.00	4.00	1.00	1.00	5.00	2.00	2.00									
28	3.00	2.00	2.00	1.00	5.00	1.00	2.00	4.00									
29	1.00	1.00	3.00	2.00	5.00	3.00	5.00	5.00									

The 'One-Way ANOVA' dialog box is open, showing the following configuration:

- Dependent List:** Satisfaction with pl..., Satisfaction with se..., Performance satisfi..., Satisfaction with e...
- Factor:** Nationality [Q1]
- Buttons:** Contrasts..., Post Hoc..., Options..., Bootstrap...

A red box highlights the text 'Independent Variable' with an arrow pointing to the 'Factor' field.

*Output1 [Document1] - IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Output Log Oneway Title Notes Active Dataset ANOVA Post Hoc Tests Title Multiple Comparisons Homogeneous Title Satisfaction Satisfaction Performance Satisfaction

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Satisfaction with place	Between Groups	.974	2	.487	.320	.729
	Within Groups	41.026	27	1.519		
	Total	42.000	29			
Satisfaction with services	Between Groups	12.474	2	6.237	3.914	.032
	Within Groups	43.026	27	1.594		
	Total	55.500	29			
Performance satisfaction	Between Groups	.100	2	.050	.026	.974
	Within Groups	52.200	27	1.933		
	Total	52.300	29			
Satisfaction with employees	Between Groups	3.750	2	1.875	.889	.423
	Within Groups	56.950	27	2.109		
	Total	60.700	29			

Post Hoc Tests

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Nationality	(J) Nationality	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Satisfaction with place	Egyptian	Arab	.04861	.51362	.995	-1.2249	1.3221
		Foreigners	-.46250	.63156	.747	-2.0284	1.1034
	Arab	Egyptian	-.04861	.51362	.995	-1.3221	1.2249
		Foreigners	-.51111	.68756	.740	-2.2158	1.1936
	Foreigners	Egyptian	.46250	.63156	.747	-1.1034	2.0284
		Arab	.51111	.68756	.740	-1.1936	2.2158
Satisfaction with services	Egyptian	Arab	.95139	.52599	.186	-.3528	2.2555
		Foreigners	1.66250*	.64677	.041	.0589	3.2661
	Arab	Egyptian	-.95139	.52599	.186	-2.2555	.3528
		Foreigners	.71111	.70411	.577	-1.0347	2.4569
	Foreigners	Egyptian	-1.66250*	.64677	.041	-3.2661	-.0589
		Arab	-.71111	.70411	.577	-2.4569	1.0347
Performance satisfaction	Egyptian	Arab	-.08333	.57935	.989	-1.5198	1.3531

IBM SPSS Statistics Processor is ready

Type here to search

33°C Sunny 1:40 PM 6/23/2021

Less than 0.05 (the level of significance)

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Satisfaction with place	Between Groups	.974	2	.487	320	.729
	Within Groups	41.026	27	1.519		
	Total	42.000	29			
Satisfaction with services	Between Groups	12.474	2	6.237	3.914	.032
	Within Groups	43.026	27	1.594		
	Total	55.500	29			
Performance satisfaction	Between Groups	.100	2	.050	.026	.974
	Within Groups	52.200	27	1.933		
	Total	52.300	29			
Satisfaction with employees	Between Groups	3.750	2	1.875	.889	.423
	Within Groups	56.950	27	2.109		
	Total	60.700	29			

Study hypotheses test

Nationality

	Question	Significance	Statistical decision
1	Satisfaction with place	0.729	Not statistically significant
2	Satisfaction with services	0.032	Statistically significant
3	Performance Satisfaction	0.974	Not statistically significant
4	Satisfaction with employees	0.423	Not statistically significant

Post Hoc Tests

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Nationality	(J) Nationality	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Satisfaction with place	Egyptian	Arab	.04861	.51362	.995	-1.2249	1.3221
		Foreigners	-.46250	.63156	.747	-2.0284	1.1034
	Arab	Egyptian	-.04861	.51362	.995	-1.3221	1.2249
		Foreigners	-.51111	.68756	.740	-2.2158	1.1936
	Foreigners	Egyptian	.46250	.63156	.747	-1.1034	2.0284
		Arab	.51111	.68756	.740	-1.1936	2.2158
Satisfaction with services	Egyptian	Arab	.95139	.52599	.186	-.3528	2.2555
		Foreigners	1.66250*	.64677	.041	.0589	3.2661
	Arab	Egyptian	-.95139	.52599	.186	-2.2555	.3528
		Foreigners	.71111	.70411	.577	-1.0347	2.4569
	Foreigners	Egyptian	-1.66250*	.64677	.041	-3.2661	-.0589
		Arab	-.71111	.70411	.577	-2.4569	1.0347
Performance satisfaction	Egyptian	Arab	-.08333	.57935	.989	-1.5198	1.3531
		Foreigners	-.15000	.71239	.976	-1.9163	1.6163

Statistical decision

Looking at the results of the post-tests of the satisfaction with services, we find that the resulting probabilistic value between the respondents with Egyptian and those with Foreigners is 0.041, which is less than 0.05 (the level of significance), so we say that there are statistically significant differences between the respondents with Egyptian and those with Foreigners and that The differences between the rest of the respondents are not statistically significant

IBM SPSS Statistics Data Editor window showing a dataset with 29 rows and 18 columns. The columns are labeled Q1, Q2, Q3, Q4, X1, X2, X3, X4, and seven 'var' columns. The data is displayed in a grid view.

The 'One-Way ANOVA' dialog box is open, showing the following configuration:

- Dependent List:** Satisfaction with pl..., Satisfaction with se..., Performance satisfi..., Satisfaction with e...
- Factor:** Education Level [Q3]
- Contrasts:** (button)
- Post Hoc:** (button)
- Options:** (button)
- Bootstrap:** (button)

A red box highlights the 'Independent Variable' label, which is pointing to the 'Factor' field (Education Level [Q3]).

The bottom status bar shows: IBM SPSS Statistics Processor is ready. 33°C Sunny 2:21 PM 6/23/2021.

*Output1 [Document1] - IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Output

- Log
- Oneway
 - Title
 - Notes
 - Active Dataset
 - ANOVA
 - Post Hoc Tests
 - Title
 - Multiple Comparisons
 - Homogeneous
 - Title
 - Satisfaction
 - Performance
 - Satisfaction
- Log
- Oneway
 - Title
 - Notes
 - Active Dataset
 - Warnings
 - ANOVA
 - Log
 - Oneway
 - Title
 - Notes
 - Active Dataset
 - ANOVA
 - Post Hoc Tests
 - Title
 - Multiple Comparisons
 - Homogeneous
 - Title
 - Satisfaction
 - Performance
 - Satisfaction

→ **Oneway**

[DataSet2] C:\Users\Dr.Al Faisal\Documents\25-6-2021.sav

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Satisfaction with place	Between Groups	9.138	3	3.046	2.410	.090
	Within Groups	32.862	26	1.264		
	Total	42.000	29			
Satisfaction with services	Between Groups	5.710	3	1.903	.994	.411
	Within Groups	49.790	26	1.915		
	Total	55.500	29			
Performance satisfaction	Between Groups	14.210	3	4.737	3.233	.039
	Within Groups	38.090	26	1.465		
	Total	52.300	29			
Satisfaction with employees	Between Groups	2.752	3	.917	.412	.746
	Within Groups	57.948	26	2.229		
	Total	60.700	29			

Post Hoc Tests

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Education Level	(J) Education Level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Satisfaction with place	Less than Secondary	Secondary	.01429	.55403	1.000	-1.5056	1.5342
		Graduate	-1.28571	.60093	.167	-2.9343	.3628
		Postgraduate	.04762	.62547	1.000	-1.6682	1.7635
	Secondary	Less than Secondary	-.01429	.55403	1.000	-1.5342	1.5056
		Graduate	-1.30000	.55403	.113	-2.8199	.2199
		Postgraduate	.03333	.58056	1.000	-1.5593	1.6260
	Graduate	Less than Secondary	1.28571	.60093	.167	-.3628	2.9343
		Secondary	1.30000	.55403	.113	-.2199	2.8199

IBM SPSS Statistics Processor is ready

Type here to search

33°C Sunny 2:21 PM 6/23/2021

Less than 0.05 (the level of significance)

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Satisfaction with place	Between Groups	9.138	3	3.046	2.410	.090
	Within Groups	32.862	26	1.264		
	Total	42.000	29			
Satisfaction with services	Between Groups	5.710	3	1.903	.994	.411
	Within Groups	49.790	26	1.915		
	Total	55.500	29			
Performance satisfaction	Between Groups	14.210	3	4.737	3.233	.039
	Within Groups	38.090	26	1.465		
	Total	52.300	29			
Satisfaction with employees	Between Groups	2.752	3	.917	.412	.746
	Within Groups	57.948	26	2.229		
	Total	60.700	29			

Study hypotheses test

Educational Level

	Question	Significance	Statistical decision
1	Satisfaction with place	0.09	Not statistically significant
2	Satisfaction with services	0.411	Not statistically significant
3	Performance Satisfaction	0.039	Statistically significant
4	Satisfaction with employees	0.746	Not statistically significant

		Graduate	.55238	.70398	.818	.58845	1.1337
Performance satisfaction	Less than Secondary	Secondary	1.11429	.59648	.266	-.5221	2.7506
		Graduate	-.57143	.64698	.813	-2.3463	1.2034
		Postgraduate	.88095	.67339	.566	-.9664	2.7283
	Secondary	Less than Secondary	-1.11429	.59648	.266	-2.7506	.5221
		Graduate	-1.68571*	.59648	.042	-3.3221	-.0494
		Postgraduate	-.23333	.62504	.982	-1.9480	1.4813
	Graduate	Less than Secondary	.57143	.64698	.813	-1.2034	2.3463
		Secondary	1.68571*	.59648	.042	.0494	3.3221
		Postgraduate	1.45238	.67339	.162	-.3950	3.2997
	Postgraduate	Less than Secondary	-.88095	.67339	.566	-2.7283	.9664
		Secondary	.23333	.62504	.982	-1.4813	1.9480
		Graduate	-1.45238	.67339	.162	-3.2997	.3950
Satisfaction with employees	Less than Secondary	Secondary	.10000	.73571	.999	-1.9183	2.1183
		Graduate	.57143	.70700	.800	-1.6177	2.7606

Statistical decision

Looking at the results of the post-tests of the performance satisfaction, we find that the resulting probabilistic value between the respondents with Secondary level students and those with Graduate is 0.039, which is less than 0.05 (the level of significance), so we say that there are statistically significant differences between the respondents Secondary level students and those with Graduate and that The differences between the rest of the respondents are not statistically significant

Study hypotheses test

City

	Question	Significance	Statistical decision
1	Satisfaction with place	0.603	Not statistically significant
2	Satisfaction with services	0.164	Not statistically significant
3	Performance Satisfaction	0.256	Not statistically significant
4	Satisfaction with employees	0.109	Not statistically significant

Study hypotheses test

- 1- There are no statistically significant differences at the significance level (0.05) between Satisfaction with place according to the variable (City - Gender - Educational level - Nationality).
- 2- There are no statistically significant differences at the significance level (0.05) between Satisfaction with services according to the variable (City - Gender - Educational level). There are also statistically significant differences between Satisfaction with services according to Nationality variable, and this is due to the presence of differences between Egyptian and Foreigners .

Study hypotheses test

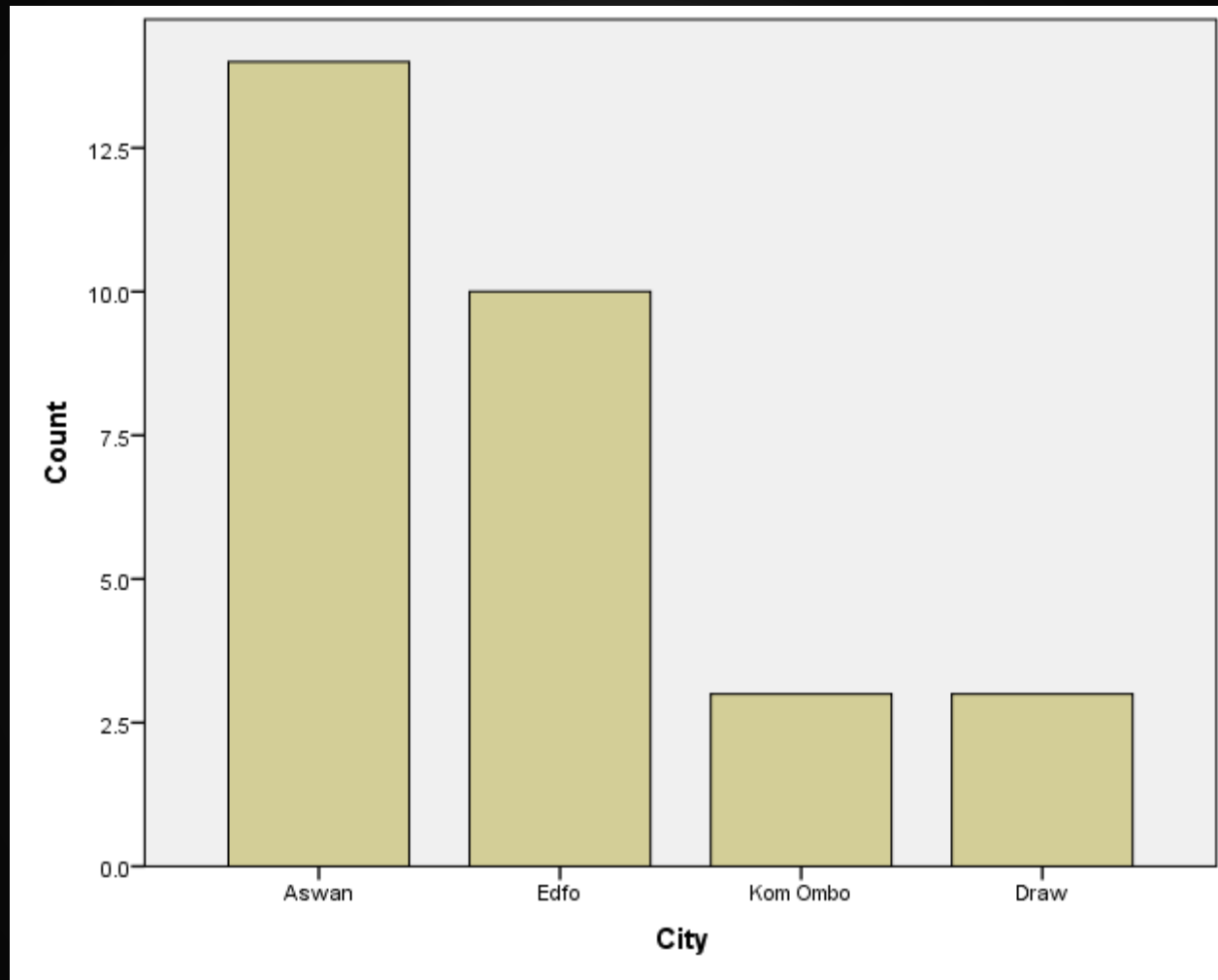
3- There are no statistically significant differences at the significance level (0.05) between Performance Satisfaction according to the variable (City - Gender - Nationality). There are also statistically significant differences between Performance Satisfaction according to the educational level variable, and this is due to the presence of differences between respondents who obtained a secondary qualification and those who obtained graduate studies.

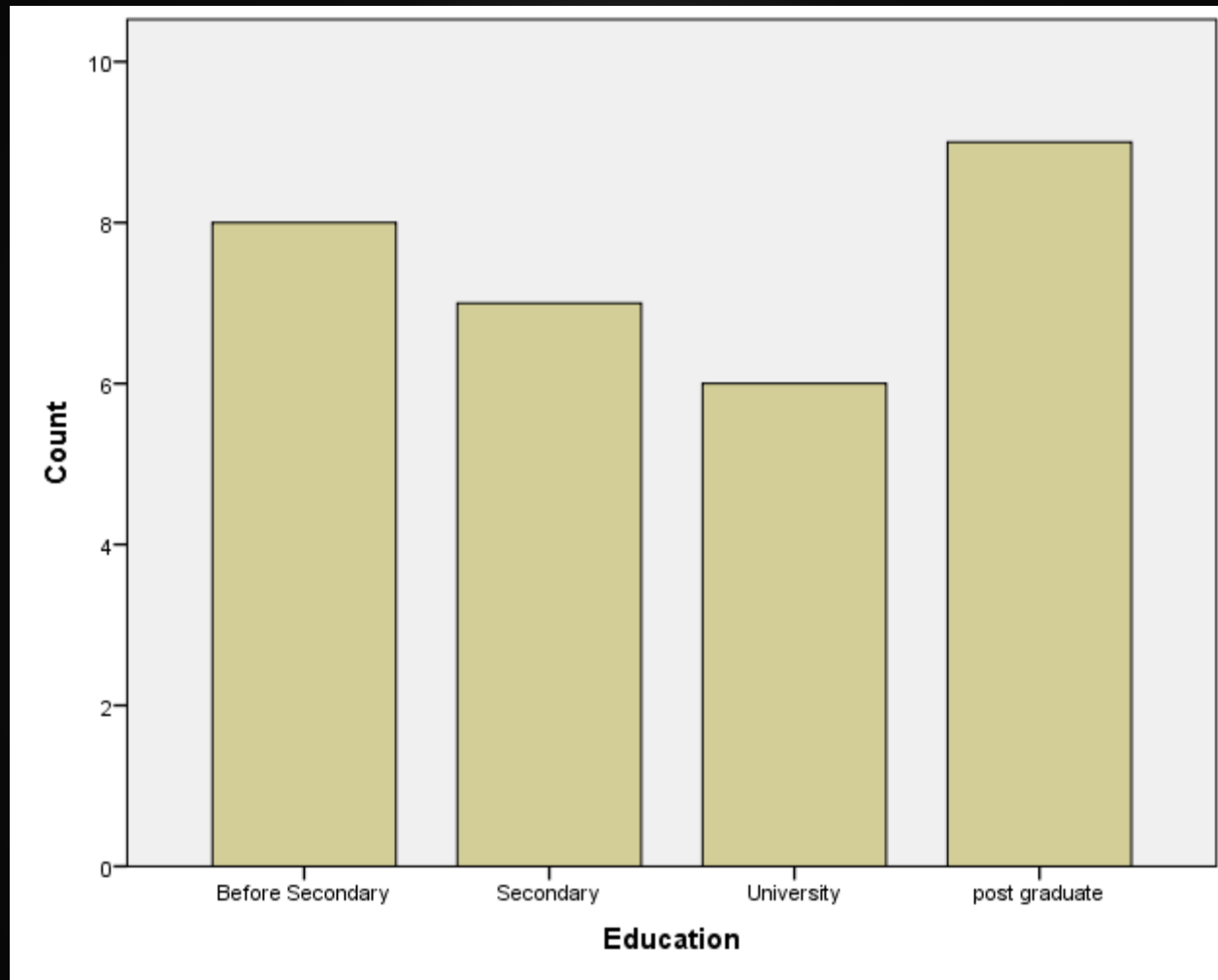
4- There are no statistically significant differences at the significance level (0.05) between Satisfaction with employees according to the variable (City - Gender - Educational level - Nationality).

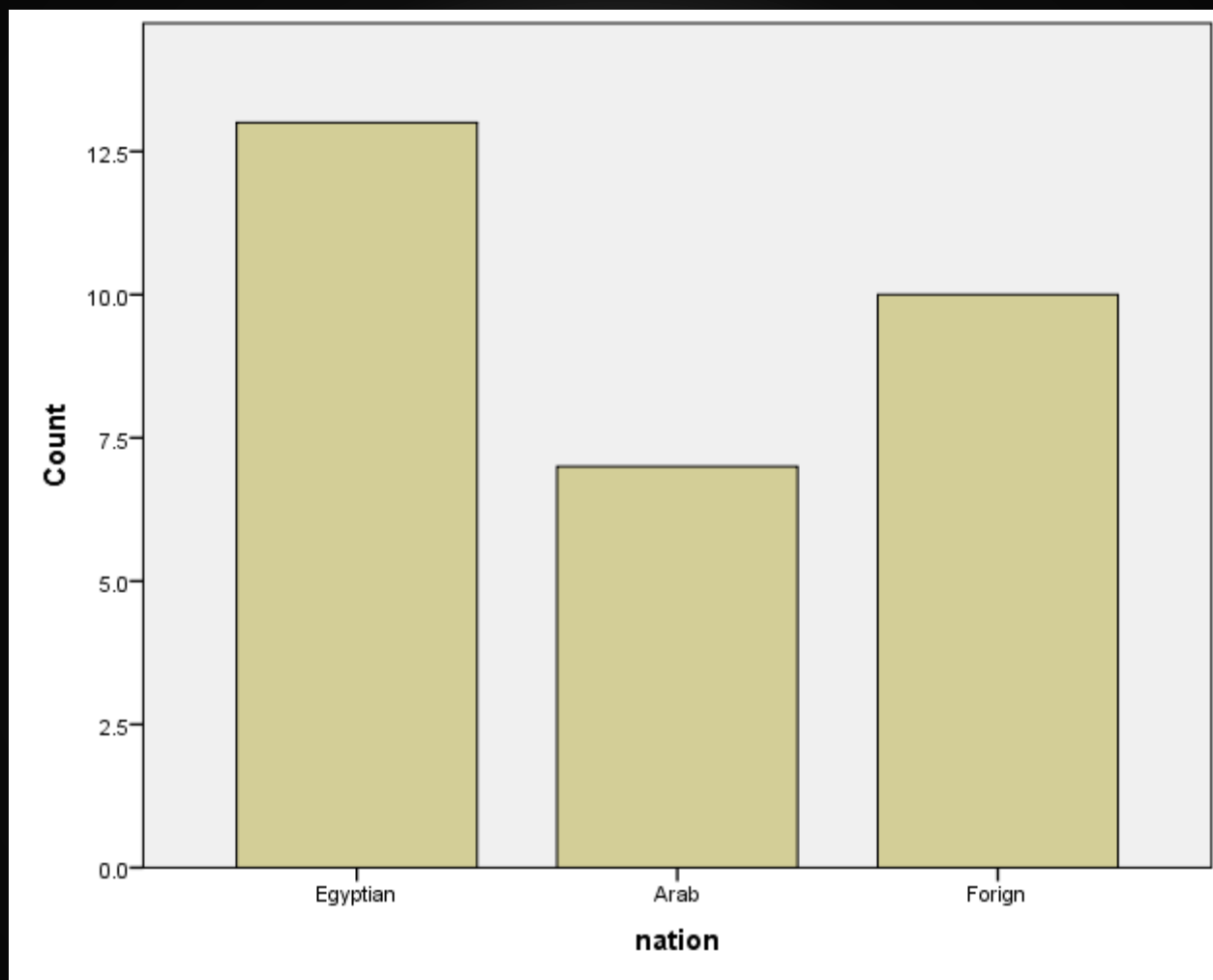
Statistics

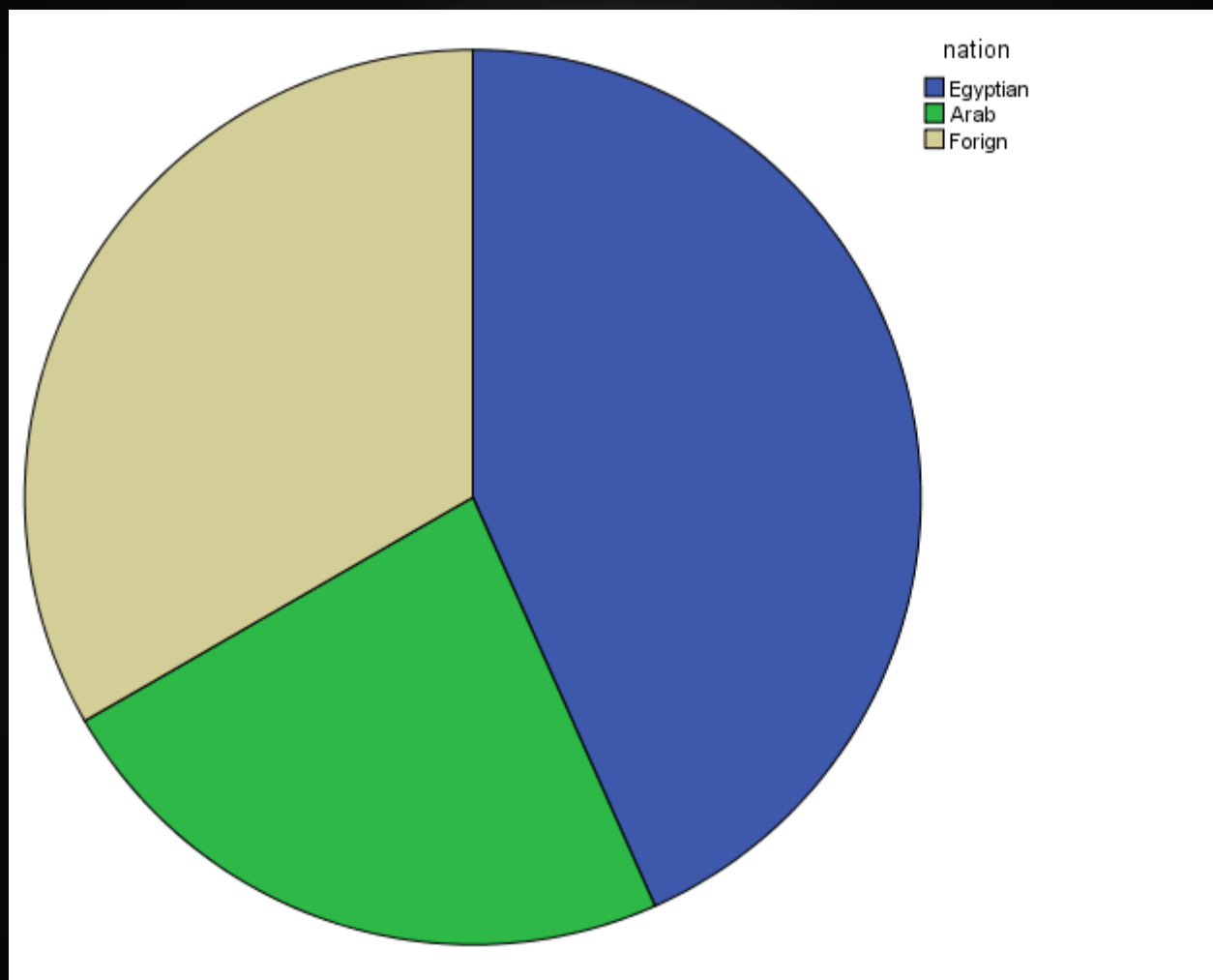
		Satisfaction with place	Satisfaction with services	Performance satisfaction	Satisfaction with employees
N	Valid	30	30	30	30
	Missing	0	0	0	0
Mean		4.0000	3.5000	3.3000	2.9000
Std. Deviation		1.20344	1.38340	1.34293	1.44676

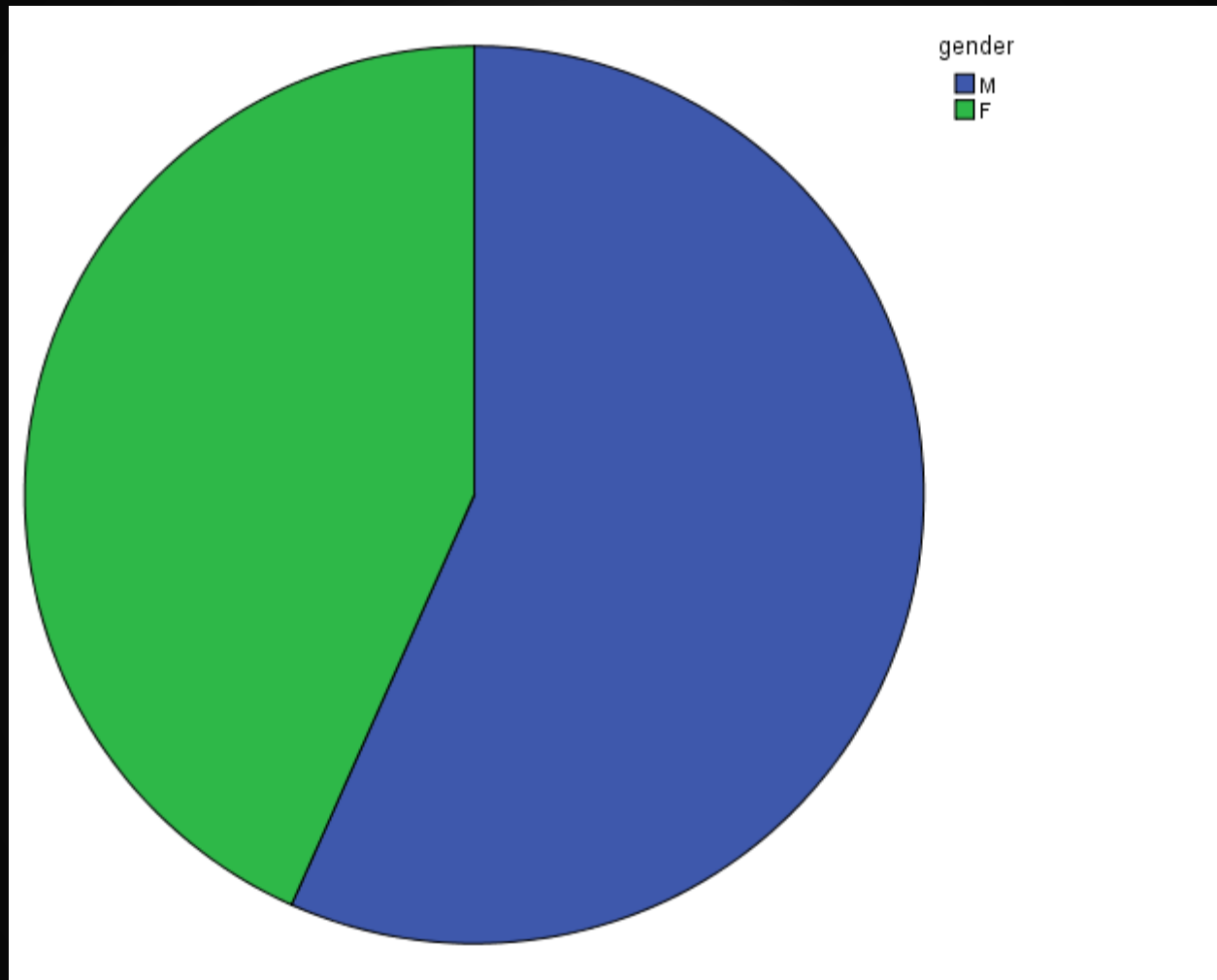
	Mean	Percentage	Strength	Standard Deviation
Satisfaction with place	4.0	80%	Strong	1.20
Satisfaction with services	3.5	70%	Strong	1.38
Performance Satisfaction	3.3	66%	Intermediate	1.34
Satisfaction with employees	2.9	58%	Intermediate	1.45











Two Way Anova

A test to determine whether two independent variables affect one dependent variable

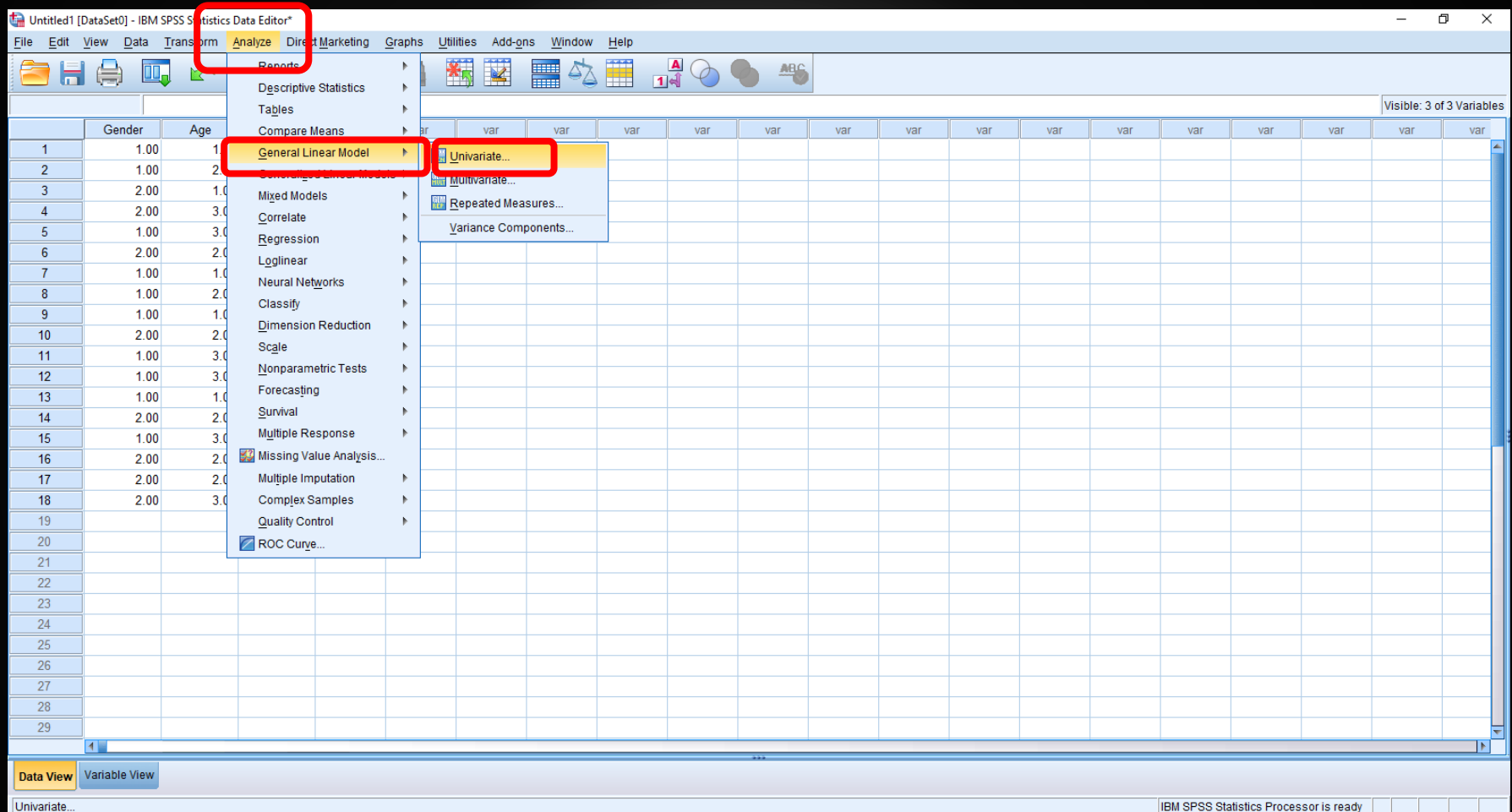
**The effect of gender variable (male - female) and
age variable (less than 20 - from 20 to 40 -
greater than 40) on productivity in a factory
according to the given data**



الوحدات المنتجة	الفئة العمرية	النوع
64	1	1
43	2	1
74	1	2
36	3	2
34	3	1
55	2	2
57	1	1
38	2	1
61	1	1
73	2	2
25	3	1
32	3	1
42	1	1
75	2	2
22	3	1
43	2	2
30	2	2
21	3	2

الفئة العمرية	الترميز
أقل من 20	1
20 – 40	2
أكبر من 40	3

النوع	الترميز
ذكر	1
أنثى	2



Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 3 of 3 Variables

	Gender	Age	Production	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	1.00	64.00																
2	1.00	2.00	43.00																
3	2.00	1.00	74.00																
4	2.00	3.00	36.00																
5	1.00	3.00	34.00																
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15	1.00	3.00	22.00																
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Univariate

Dependent Variable:

Fixed Factor(s):

Random Factor(s):

Covariate(s):

WLS Weight:

Model... Contrasts... Plots... Post Hoc... Save... Options... Bootstrap...

OK Paste Reset Cancel Help

Data View Variable View

IBM SPSS Statistics Processor is ready

2:58 PM 11/11/2019

Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor*

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 3 of 3 Variables

	Gender	Age	Production	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	1.00	64.00																
2	1.00	2.00	43.00																
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Univariate

Dependent Variable: Production

Fixed Factor(s): Gender, Age

Random Factor(s):

Covariate(s):

WLS Weight:

Model...
Plots...
Post Hoc...
Save...
Options...
Bootstrap...

OK Paste Reset Cancel Help

Data View Variable View

IBM SPSS Statistics Processor is ready

2:58 PM
11/11/2019

Two way Anova_2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 3 of 3 Variables

	Gender	Age	Production	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	1.00	64.00																
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15	1.00	3.00	22.00																
16	2.00	2.00	43.00																
17	2.00	2.00	30.00																
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Univariate: Model

Specify Model

☒ Full factorial ☐ Custom

Factors & Covariates:

Gender
Age

Model:

Build Term(s)

Type:

Interaction

Sum of squares: Type III

☒ Include intercept in model

Continue Cancel Help

Data View Variable View

IBM SPSS Statistics Processor is ready

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11/11/2019

Two way Anova_2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 3 of 3 Variables

	Gender	Age	Production	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
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28																			
29																			

Univariate: Model

Specify Model:
☐ Full factorial
☒ Custom

Factors & Covariates:
 Gender
 Age

Model:

Build Term(s)
 Type:
 Interaction

Sum of squares: Type III
☒ Include intercept in model

Continue Cancel Help

Data View Variable View

IBM SPSS Statistics Processor is ready

3:01 PM 11/11/2019

Two way Anova_2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

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14	2.00	2.00	75.00																
15	1.00	3.00	22.00																
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Univariate: Model

Specify Model

☐ Full factorial ☒ Custom

Factors & Covariates:

- Gender
- Age

Model:

Build Term(s)

Type:

Main effects

Sum of squares: Type III

☒ Include intercept in model

Continue Cancel Help

Data View Variable View

IBM SPSS Statistics Processor is ready

3:01 PM 11/11/2019

Two way Anova_2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 3 of 3 Variables

	Gender	Age	Production	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	1.00	64.00																
2	1.00	2.00	43.00																
3	2.00	1.00	74.00																
4	2.00	3.00	36.00																
5	1.00	3.00	34.00																
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7	1.00	1.00	57.00																
8	1.00	2.00	38.00																
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10	2.00	2.00	73.00																
11	1.00	3.00	25.00																
12	1.00	3.00	32.00																
13	1.00	1.00	42.00																
14	2.00	2.00	75.00																
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Univariate: Model

Specify Model

☐ Full factorial ☒ Custom

Factors & Covariates:

- Gender
- Age

Model:

- Gender
- Age

Build Term(s)

Type:

Main effects

Sum of squares: Type III

☒ Include intercept in model

Continue Cancel Help

Data View Variable View

IBM SPSS Statistics Processor is ready

3:02 PM 11/11/2019

Two way Anova_2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 3 of 3 Variables

	Gender	Age	Production	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	1.00	64.00																
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Univariate: Model

Specify Model:
☐ Full factorial
☒ Custom

Factors & Covariates:
 Gender
 Age

Model:
 Gender
 Age

Build Term(s)
 Type:
 Interaction

Sum of squares: Type III
☒ Include intercept in model

Continue Cancel Help

Data View Variable View

IBM SPSS Statistics Processor is ready

3:03 PM 11/11/2019

Two way Anova_2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 3 of 3 Variables

	Gender	Age	Production	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	1.00	64.00																	
2	1.00	2.00	43.00																	
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29																				

Univariate: Model

Specify Model

☐ Full factorial ☒ Custom

Factors & Covariates:

- Gender
- Age

Model:

- Gender
- Age
- Age*Gender

Build Term(s)

Type:

Interaction

Sum of squares: Type III

☒ Include intercept in model

Continue Cancel Help

Data View Variable View

IBM SPSS Statistics Processor is ready

3:03 PM 11/11/2019

Two way Anova_2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 3 of 3 Variables

	Gender	Age	Production	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
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Univariate: Options

Estimated Marginal Means

Factor(s) and Factor Interactions:

(OVERALL)
Gender
Age
Age*Gender

Display Means for:

(OVERALL)
Gender
Age
Age*Gender

☐ Compare main effects

Confidence interval adjustment:
LSD(none)

Display:

☒ Descriptive statistics

☒ Homogeneity tests

☐ Estimates of effect size

☐ Spread vs. level plot

☐ Observed power

☐ Residual plot

☐ Parameter estimates

☐ Lack of fit

☐ Contrast coefficient matrix

☐ General estimable function

Significance level: .05 Confidence intervals are 95.0 %

Continue Cancel Help

Data View Variable View

IBM SPSS Statistics Processor is ready

3:04 PM 11/11/2019

Two way Anova_2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 3 of 3 Variables

	Gender	Age	Production	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	1.00	64.00																
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Univariate: Options

Estimated Marginal Means

Factor(s) and Factor Interactions:

- (OVERALL)
- Gender
- Age
- Age*Gender

Display Means for:

- (OVERALL)
- Gender
- Age
- Age*Gender

☐ Compare main effects

Confidence interval adjustment:

LSD(none)

Display

- ☒ Descriptive statistics
- ☐ Estimates of effect size
- ☐ Observed power
- ☐ Parameter estimates
- ☐ Contrast coefficient matrix
- ☒ Homogeneity tests
- ☐ Spread vs. level plot
- ☐ Residual plot
- ☐ Lack of fit
- ☐ General estimable function

Significance level: .05 Confidence intervals are 95.0 %

Continue Cancel Help

Data View Variable View

IBM SPSS Statistics Processor is ready

3:05 PM 11/11/2019

Two way Anova_2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 3 of 3 Variables

	Gender	Age	Production	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
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Univariate: Post Hoc Multiple Comparisons for Observed Means

Factor(s):
Gender
Age

Post Hoc Tests for:
Age

Equal Variances Assumed

- ☐ LSD
- ☐ Bonferroni
- ☐ Sidak
- ☒ Scheffe
- ☐ R-E-G-W-F
- ☐ R-E-G-W-Q
- ☐ S-N-K
- ☐ Tukey
- ☐ Tukey's-b
- ☐ Duncan
- ☐ Hochberg's GT2
- ☐ Gabriel
- ☐ Waller-Duncan
- ☐ Dunnett

Type I/Type II Error Ratio: 100

Control Category: Last

Test:
☒ 2-sided ☐ < Control ☐ > Control

Equal Variances Not Assumed

- ☐ Tamhane's T2
- ☐ Dunnett's T3
- ☐ Games-Howell
- ☐ Dunnett's C

Continue Cancel Help

Data View Variable View

IBM SPSS Statistics Processor is ready

3:05 PM 11/11/2019

Two way Anova_2019.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 3 of 3 Variables

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Univariate: Post Hoc Multiple Comparisons for Observed Means

Factor(s):
Gender
Age

Post Hoc Tests for:
Age

Equal Variances Assumed

- ☐ LSD
- ☐ Bonferroni
- ☐ Sidak
- ☒ Scheffé
- ☐ R-E-G-W-F
- ☐ R-E-G-W-Q
- ☐ S-N-K
- ☐ Tukey
- ☐ Tukey's-b
- ☐ Duncan
- ☐ Hochberg's GT2
- ☐ Gabriel
- ☐ Waller-Duncan
- Type I/Type II Error Ratio: 100
- ☐ Dunnett
- Control Category: Last
- Test:
 - ☒ 2-sided
 - ☐ < Control
 - ☐ > Control

Equal Variances Not Assumed

- ☐ Tamhane's T2
- ☐ Dunnett's T3
- ☐ Games-Howell
- ☐ Dunnett's C

Continue Cancel Help

Data View Variable View

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Levene's Test of Equality of Error Variances^a

Dependent Variable: Production

F	df1	df2	Sig.
2.194	5	12	.123

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Gender + Age + Gender * Age

There is homogeneity in the errors of the variances

Tests of Between-Subjects Effects

Dependent Variable: Production

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3539.950 ^a	5	707.990	4.247	.019
Intercept	29547.408	1	29547.408	177.236	.000
Gender	402.112	1	402.112	2.412	.146
Age	2795.568	2	1397.784	8.384	.005
Gender * Age	209.503	2	104.752	.628	.550
Error	2000.550	12	166.713		
Total	43353.000	18			
Corrected Total	5540.500	17			

a. R Squared = .639 (Adjusted R Squared = .488)

There are no statistically significant differences between gender (male - female) and production rate

Tests of Between-Subjects Effects

Dependent Variable: Production

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3539.950 ^a	5	707.990	4.247	.019
Intercept	29547.408	1	29547.408	177.236	.000
Gender	402.112	1	402.112	2.412	.146
Age	2795.568	2	1397.784	8.384	.005
Gender * Age	209.503	2	104.752	.628	.550
Error	2000.550	12	166.713		
Total	43353.000	18			
Corrected Total	5540.500	17			

a. R Squared = .639 (Adjusted R Squared = .488)

There are statistically significant differences between the age group and the production rate

Tests of Between-Subjects Effects

Dependent Variable: Production

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3539.950 ^a	5	707.990	4.247	.019
Intercept	29547.408	1	29547.408	177.236	.000
Gender	402.112	1	402.112	2.412	.146
Age	2795.568	2	1397.784	8.384	.005
Gender * Age	209.503	2	104.752	.628	.550
Error	2000.550	12	166.713		
Total	43353.000	18			
Corrected Total	5540.500	17			

a. R Squared = .639 (Adjusted R Squared = .488)

There are no statistically significant differences in the interaction between the two variables: gender and age group

Post Hoc Tests

Age

Multiple Comparisons

Dependent Variable: Production
Scheffe

(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Less than 20	20-40	8.6000	7.56033	.541	-12.4750	29.6750
	More than 40	31.2667*	7.81843	.006	9.4722	53.0612
20-40	Less than 20	-8.6000	7.56033	.541	-29.6750	12.4750
	More than 40	22.6667*	7.18342	.027	2.6423	42.6910
More than 40	Less than 20	-31.2667*	7.81843	.006	-53.0612	-9.4722
	20-40	-22.6667*	7.18342	.027	-42.6910	-2.6423

Based on observed means.

The error term is Mean Square(Error) = 166.713.

*. The mean difference is significant at the .05 level.

There are statistically significant differences between the age group and the production rate, and this is due to the group greater than 40, which is statistically significant, while the rest of the groups are not statistically significant.



Thank you...