IENG484
Quality Engineering
Lab 2

RESEARCH ASSISTANT

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Histogram

Why we use a Histogram

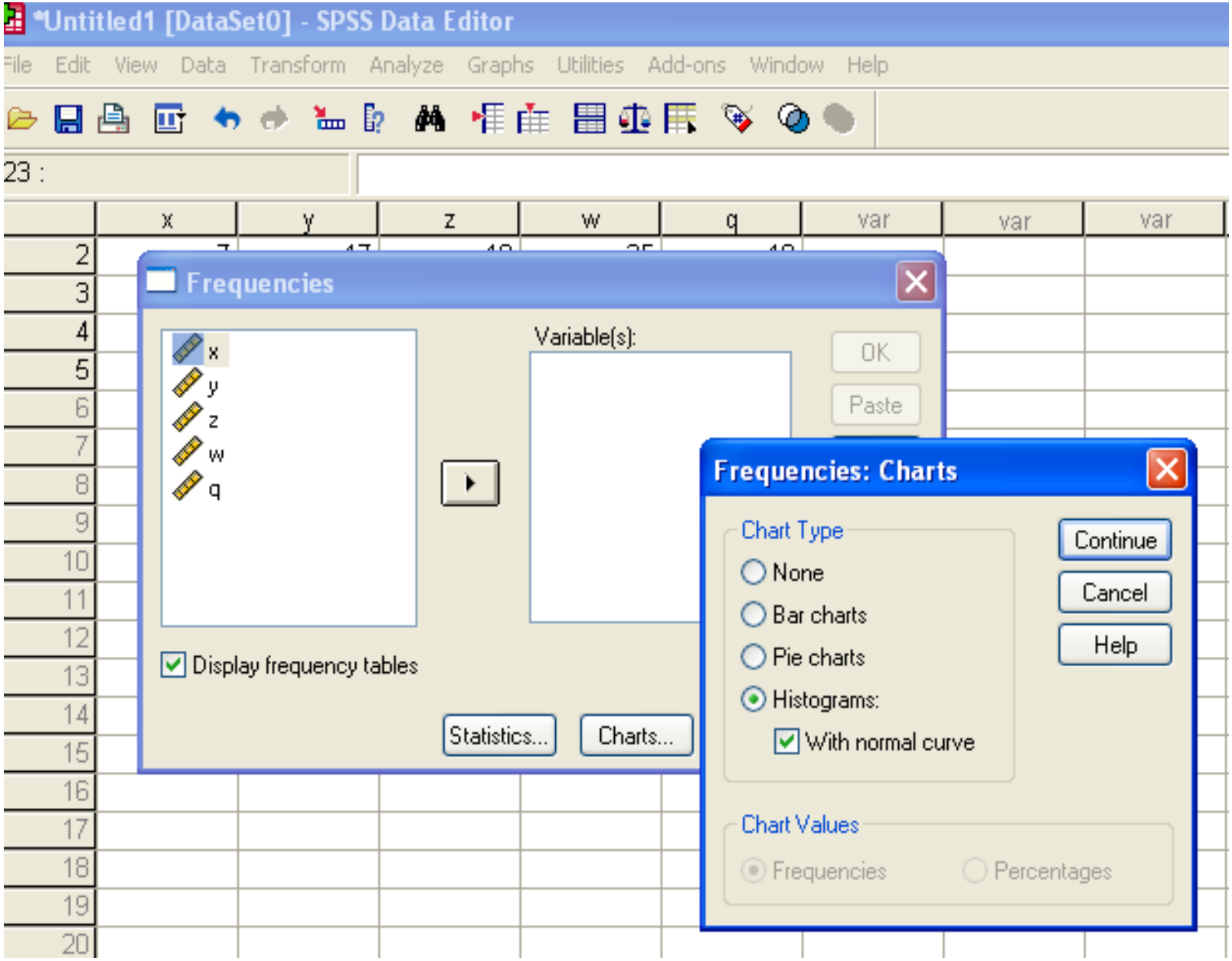
- To summarize data from a process that has been collected over a period of time, and graphically present its frequency distribution in bar form.

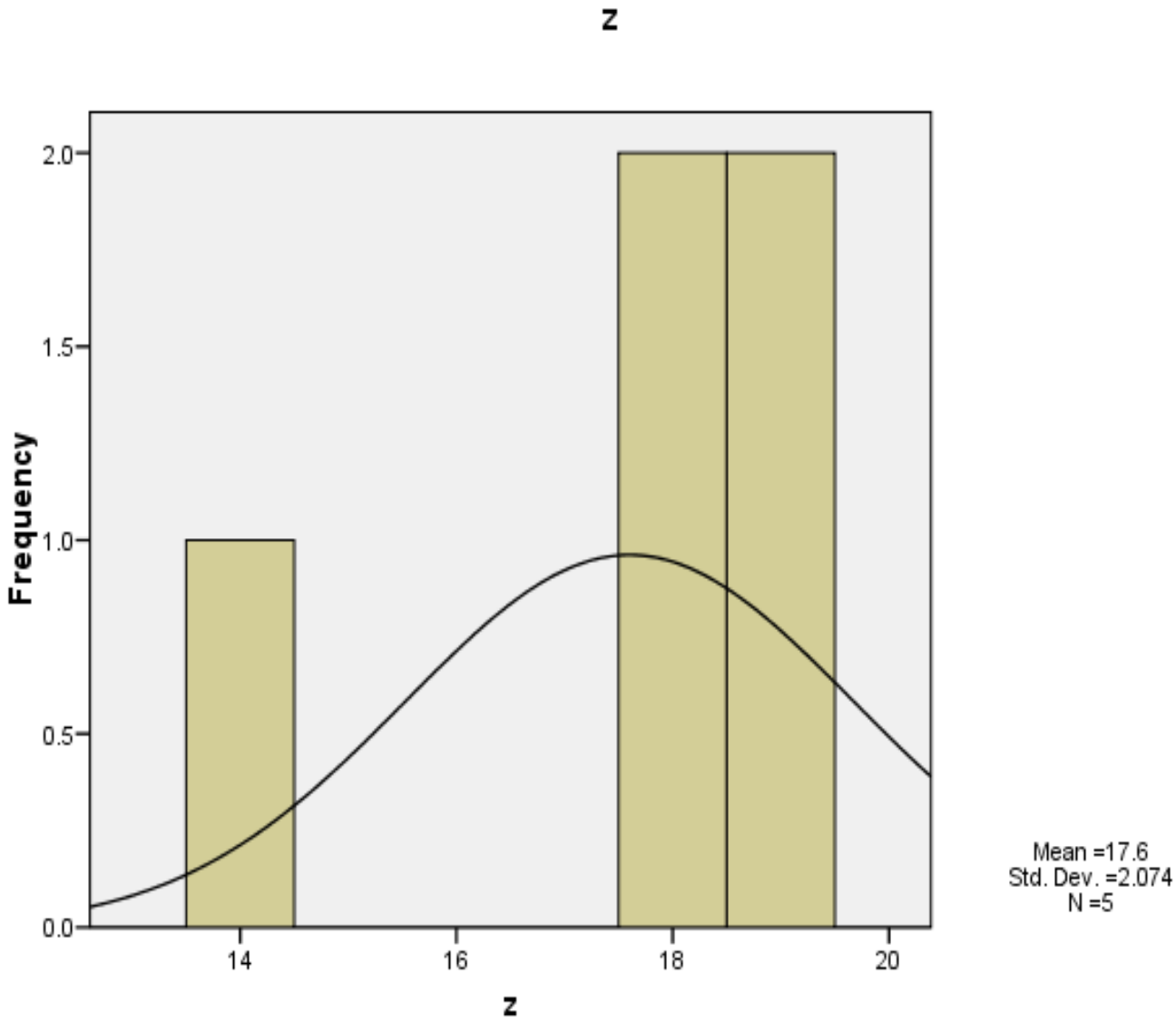
What Does a Histogram Do?

- Displays large amounts of data that are difficult to interpret in tabular form
- Shows the relative frequency of occurrence of the various data values
- Reveals the centering, variation, and shape of the data
- Illustrates quickly the underlying distribution of the data

Continue

- Provides useful information for predicting future performance of the process
- Helps to indicate if there has been a change in the process
- Helps answer the question “Is the process capable of meeting my customer requirements?”


*Untitled1 [DataSet0] - SPSS Data Editor
File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help
23 :
x y z w q var var var
Frequencies
x
y
z
w
q
Variable(s):
OK
Paste
Display frequency tables
Statistics...
Charts...
Frequencies: Charts
Chart Type
None
Bar charts
Pie charts
Histograms:
With normal curve
Continue
Cancel
Help
Chart Values
Frequencies
Percentages


z
Frequency
2.0
1.5
1.0
0.5
0.0
14
16
18
20
z
Mean =17.6
Std. Dev. =2.074
N =5

PARETO DIAGRAM

What is it?

The Pareto diagram is a graphical overview of process problems in ranking order from the most frequent, down to the least frequent. It illustrates the frequency of fault or defect types. Using a Pareto, you can decide which is the most serious or frequent offender.

History of Pareto Analysis

The principle was developed by Vilfredo Pareto, an Italian economist and sociologist who conducted a study in Europe in the early 1900s on wealth and poverty. He found that wealth was concentrated in the hands of the few and poverty in the hands of the many. The Pareto principle is based on the unequal distribution of things in the universe.

Pareto Principle

- The basic underlying rule behind the Pareto principle is that in almost every case, 80% of the total problems incurred are caused by 20% of the problem causes.
- Therefore, by concentrating on the major problems first, you can eliminate the majority of your problems. The few problems that occur most often result in the majority of your defects. You may also have many occasional problems that cause the occasional defect. This is called the "vital few over the trivial many" rule.

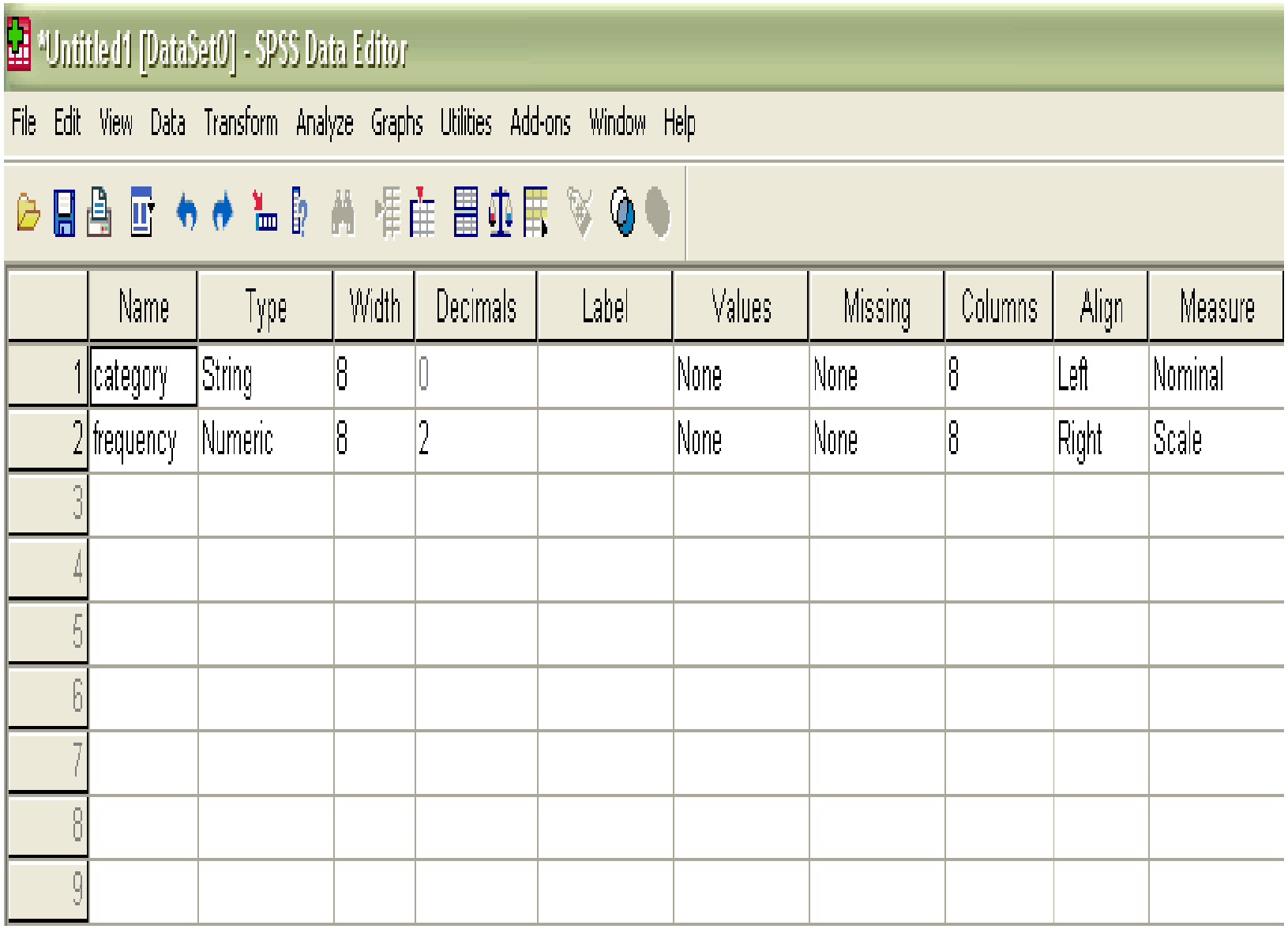
Example 1: PARETO DIAGRAM

- Please enter the data shown below in to the SPSS:

Analysis Sheet

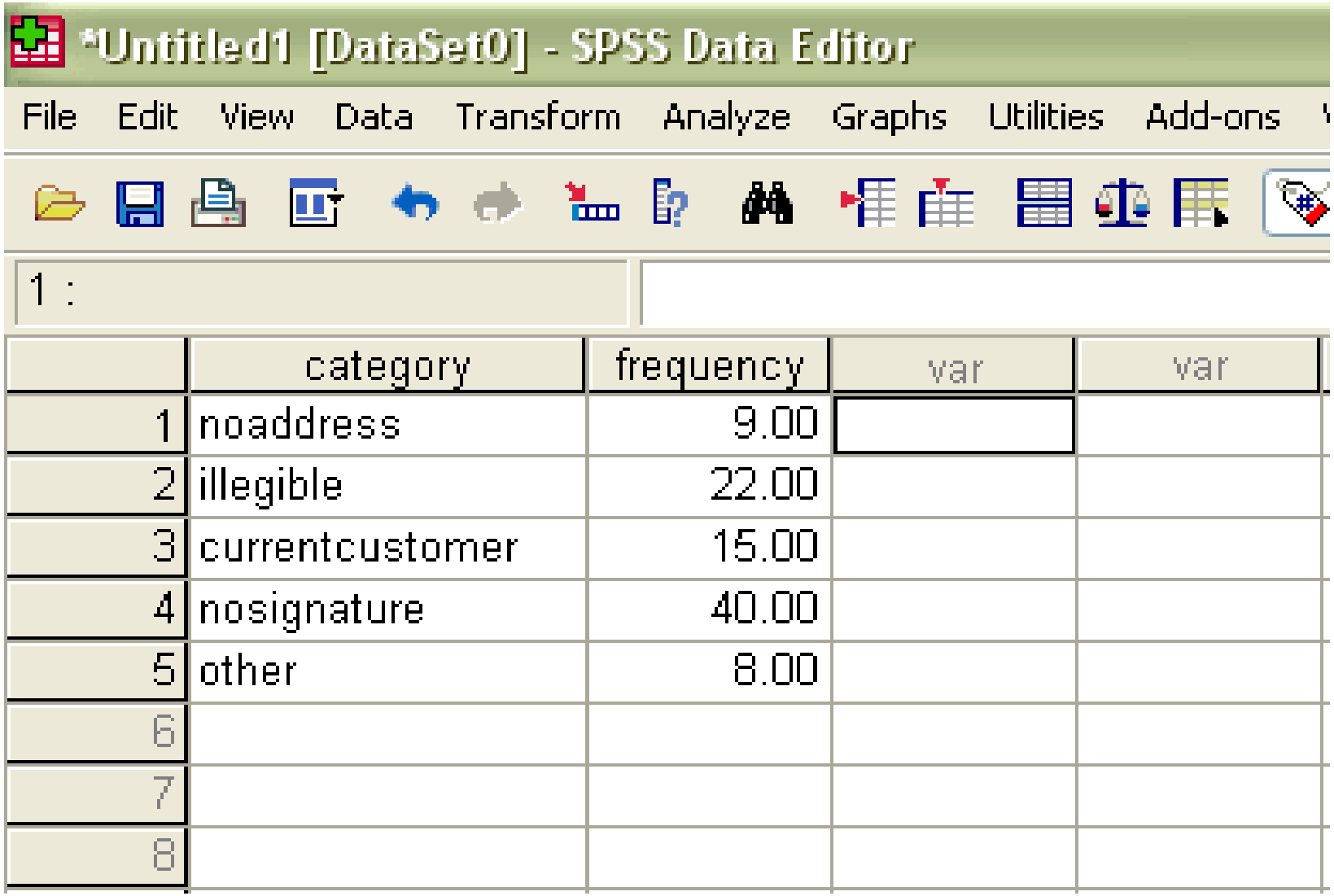
Category	Frequency		
No address	9		
Illegible	22		
Current customer	15		
No signature	40		
Other	8		

Variable view

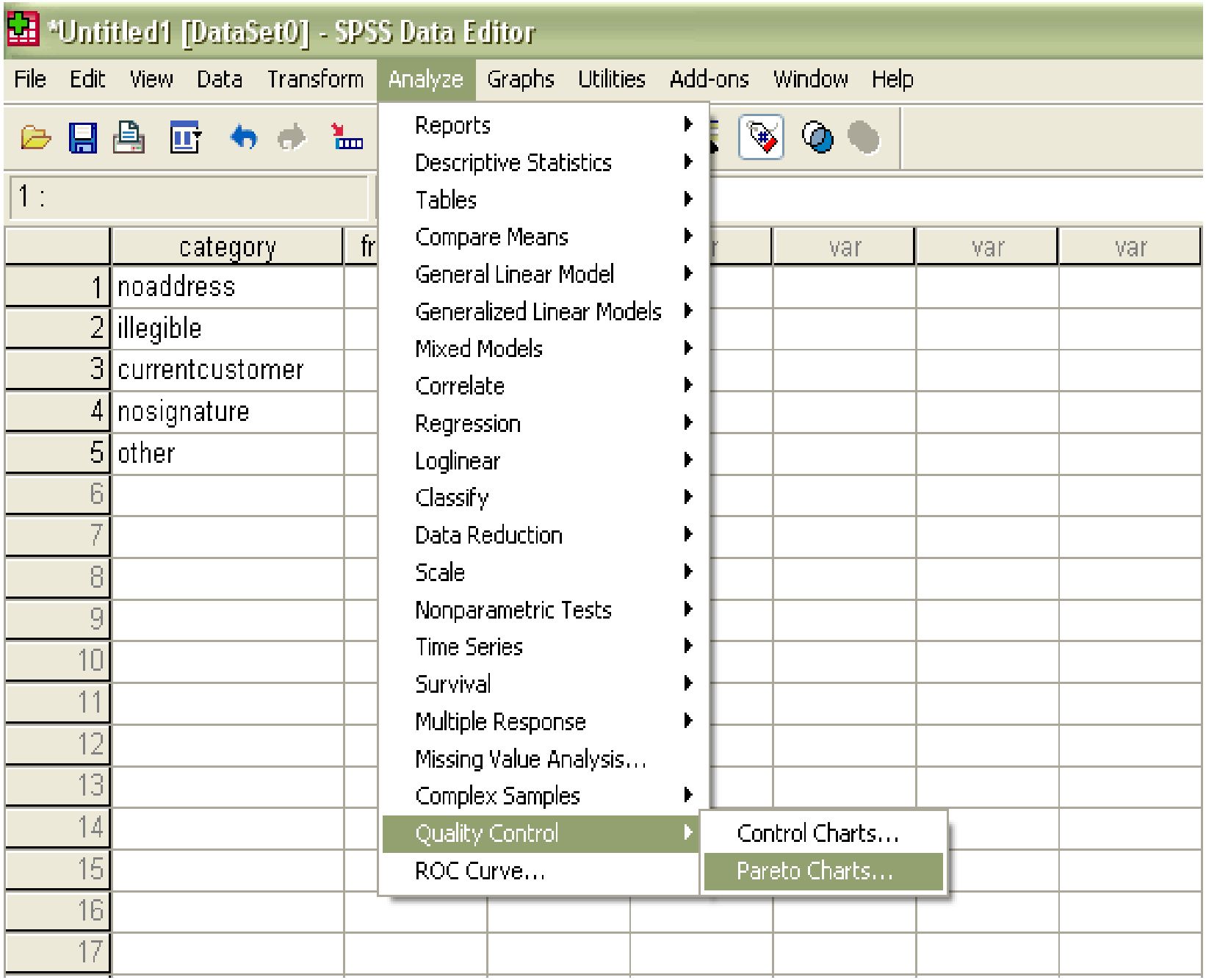


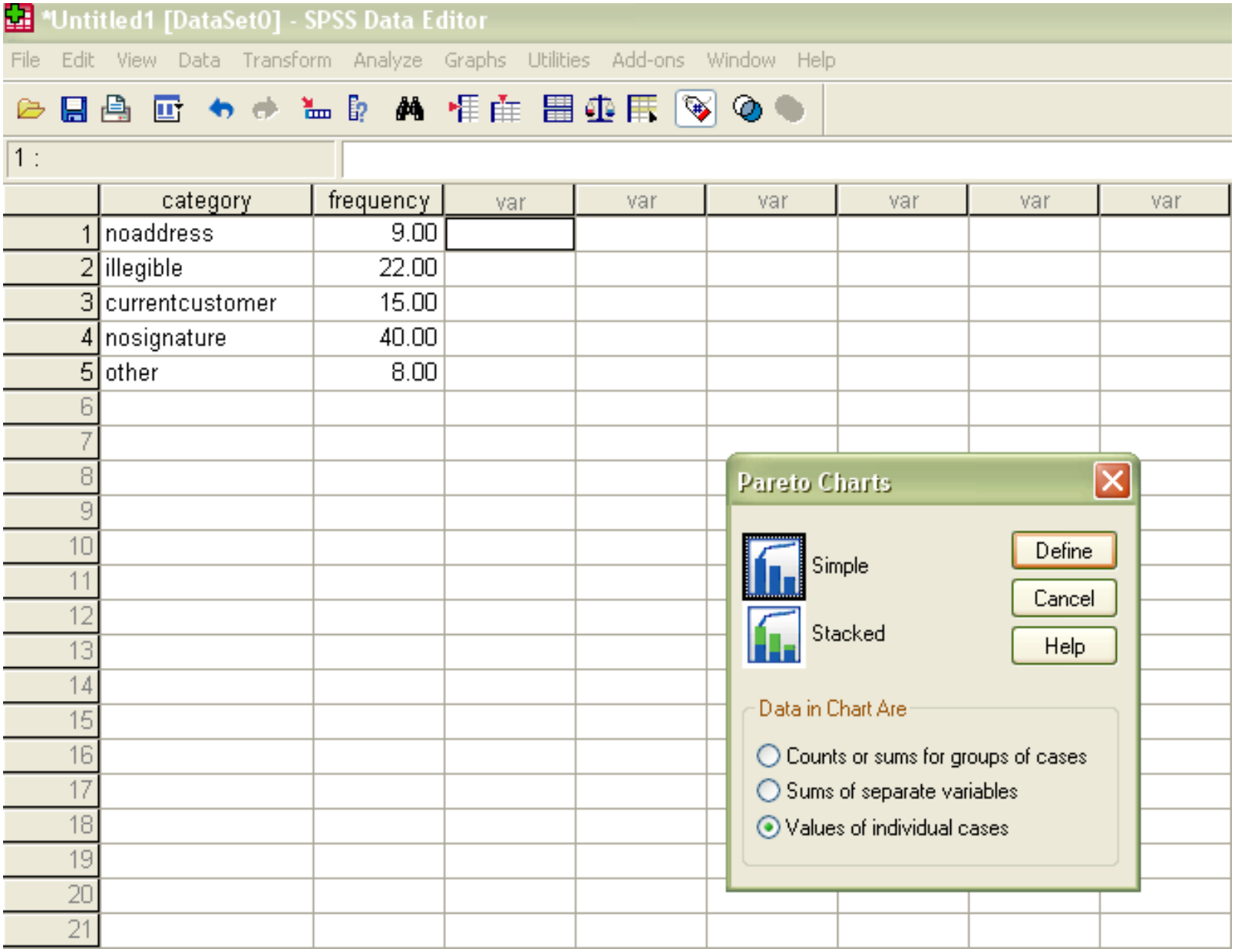
	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
1	category	String	8	0		None	None	8	Left	Nominal
2	frequency	Numeric	8	2		None	None	8	Right	Scale
3										
4										
5										
6										
7										
8										
9										

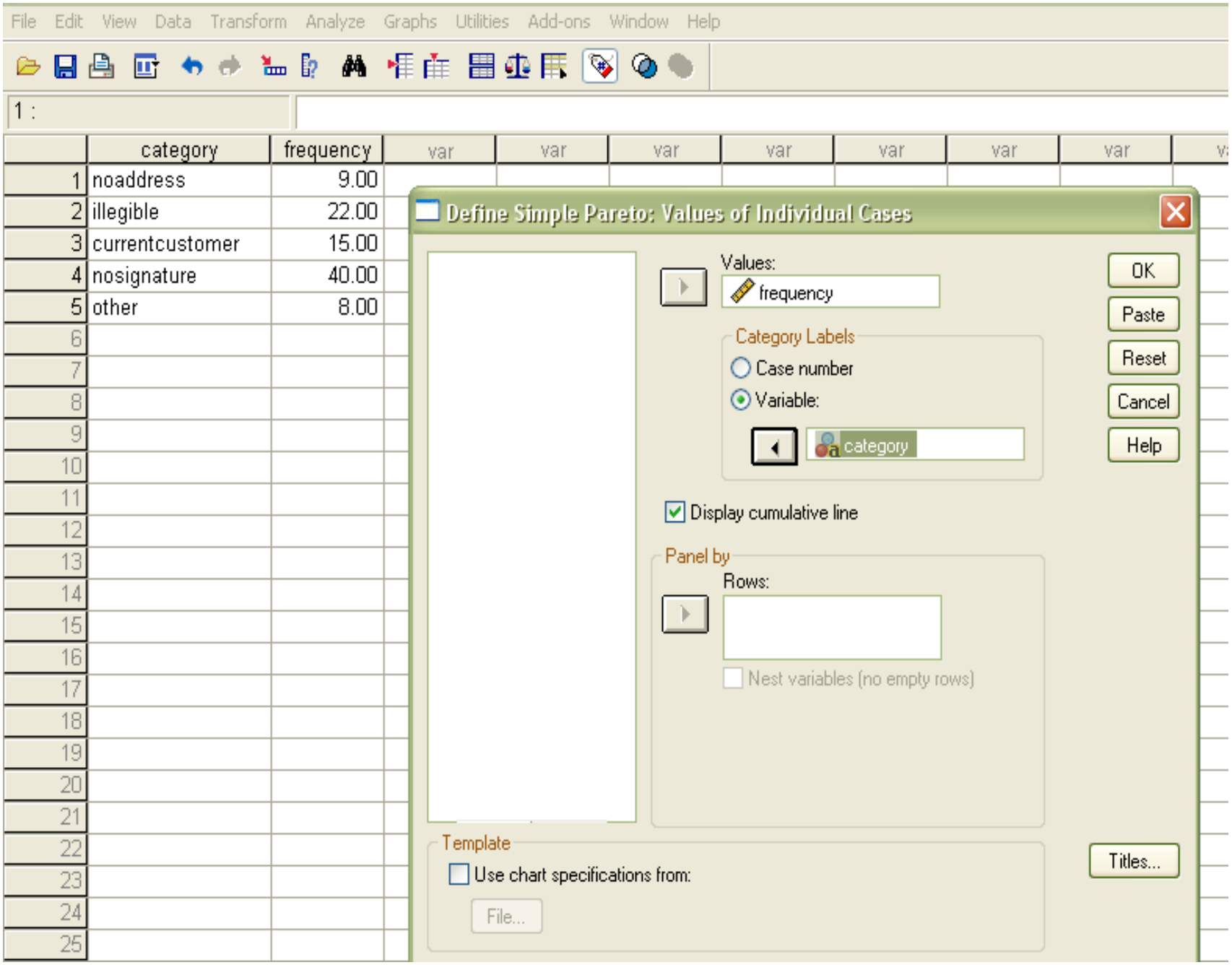
Data view



	category	frequency	var	var
1	noaddress	9.00		
2	illegible	22.00		
3	currentcustomer	15.00		
4	nosignature	40.00		
5	other	8.00		
6				
7				
8				

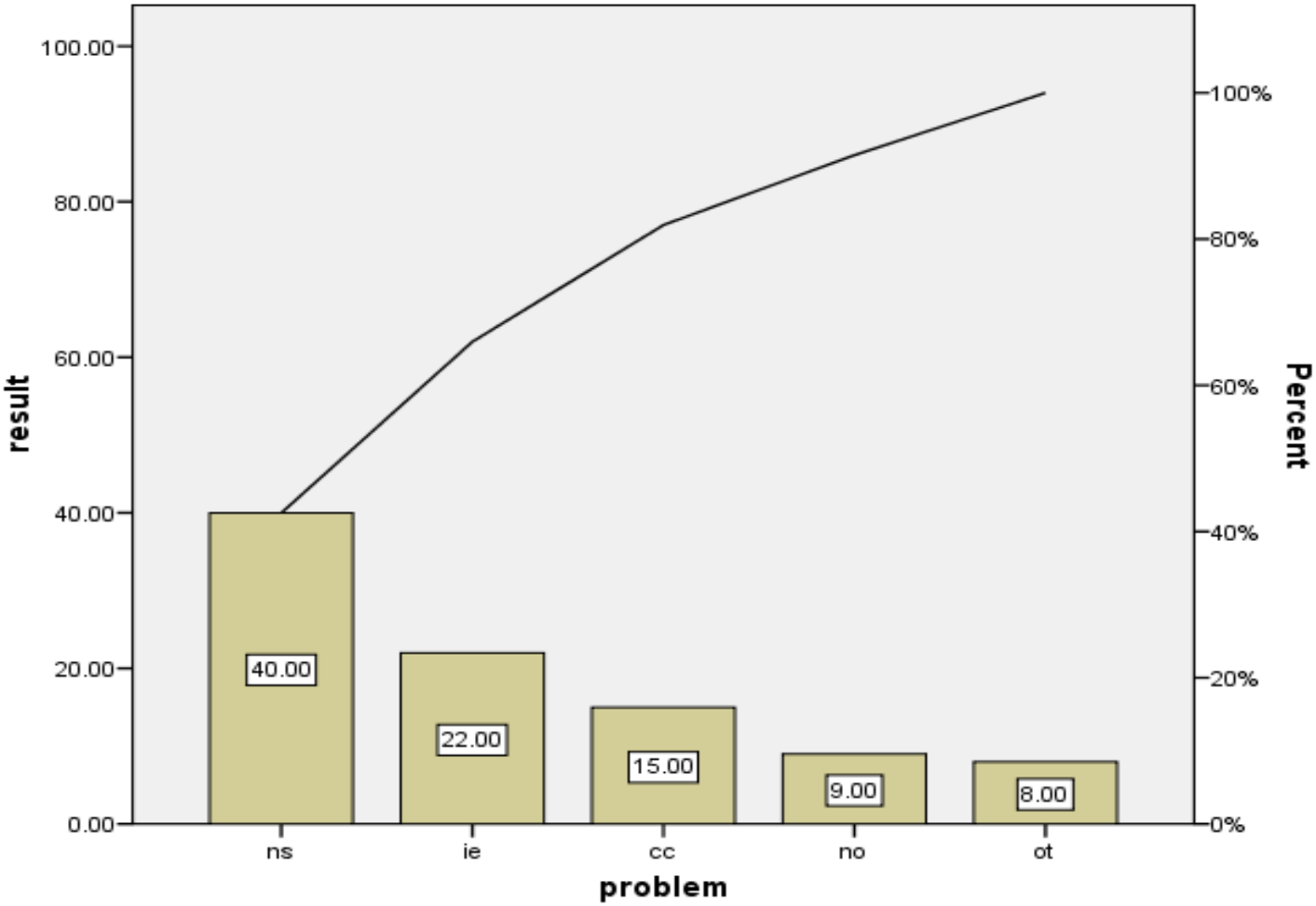

*Untitled1 [DataSet0] - SPSS Data Editor
File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help
1 :
category
fr
var
var
var
1 noaddress
2 illegible
3 currentcustomer
4 nosignature
5 other
6
7
8
9
10
11
12
13
14
15
16
17
Reports
Descriptive Statistics
Tables
Compare Means
General Linear Model
Generalized Linear Models
Mixed Models
Correlate
Regression
Loglinear
Classify
Data Reduction
Scale
Nonparametric Tests
Time Series
Survival
Multiple Response
Missing Value Analysis...
Complex Samples
Quality Control
ROC Curve...
Control Charts...
Pareto Charts...


*Untitled1 [DataSet0] - SPSS Data Editor
File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help
1 :
category
frequency
var
1 noaddress 9.00
2 illegible 22.00
3 currentcustomer 15.00
4 nosignature 40.00
5 other 8.00
Pareto Charts
Simple
Stacked
Define
Cancel
Help
Data in Chart Are
Counts or sums for groups of cases
Sums of separate variables
Values of individual cases


File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help
1 :
category
frequency
var
1 noaddress 9.00
2 illegible 22.00
3 currentcustomer 15.00
4 nosignature 40.00
5 other 8.00
Define Simple Pareto: Values of Individual Cases
Values:
frequency
Category Labels
Case number
Variable:
category
Display cumulative line
Panel by
Rows:
Nest variables (no empty rows)
Template
Use chart specifications from:
File...
OK
Paste
Reset
Cancel
Help
Titles...

GRAPH

[DataSet0]



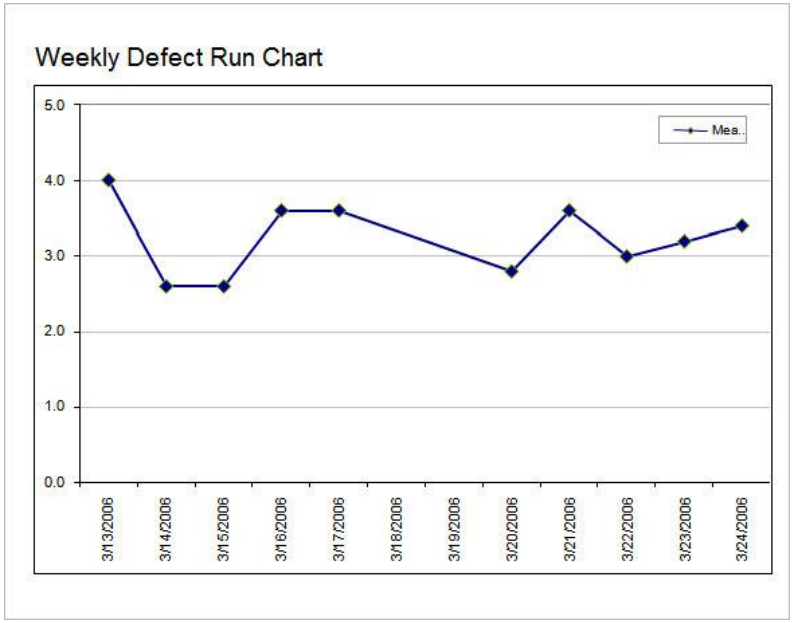
RUN CHART

What is a Run chart

- Run chart is one of the simple tools to get a quick understanding of a process behavior. If interpreted correctly, you can use it to see what part of the process needs to be improved, or whether the improvement that we have been put into place is effective.

Introduction to run Chart (cont.)

- A ‘time series’ chart tells a story.
- Baseline data helps us to see whether a change is an improvement.
- Any changes made are shown on the chart.



What is Run chart used for

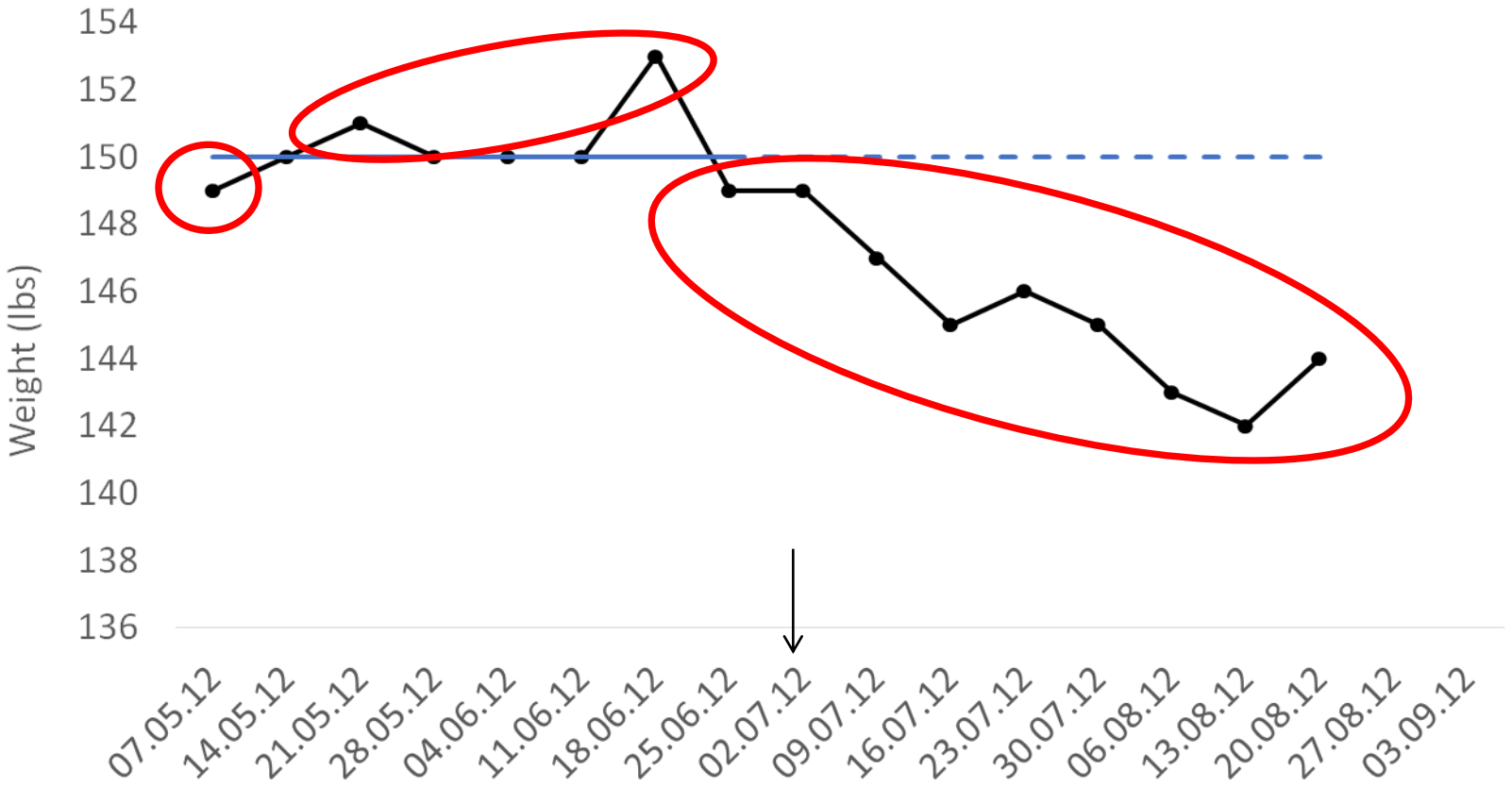
- Useful for
  - detecting patterns in the data
  - seeing if changes in process made a difference

How do we analyze a Run Chart

How will I know, what the Run Chart is trying to tell me?”

- There are 4 simple run chart rules that help you decide if your data reflect a random or non-random pattern.

First, What is a run?

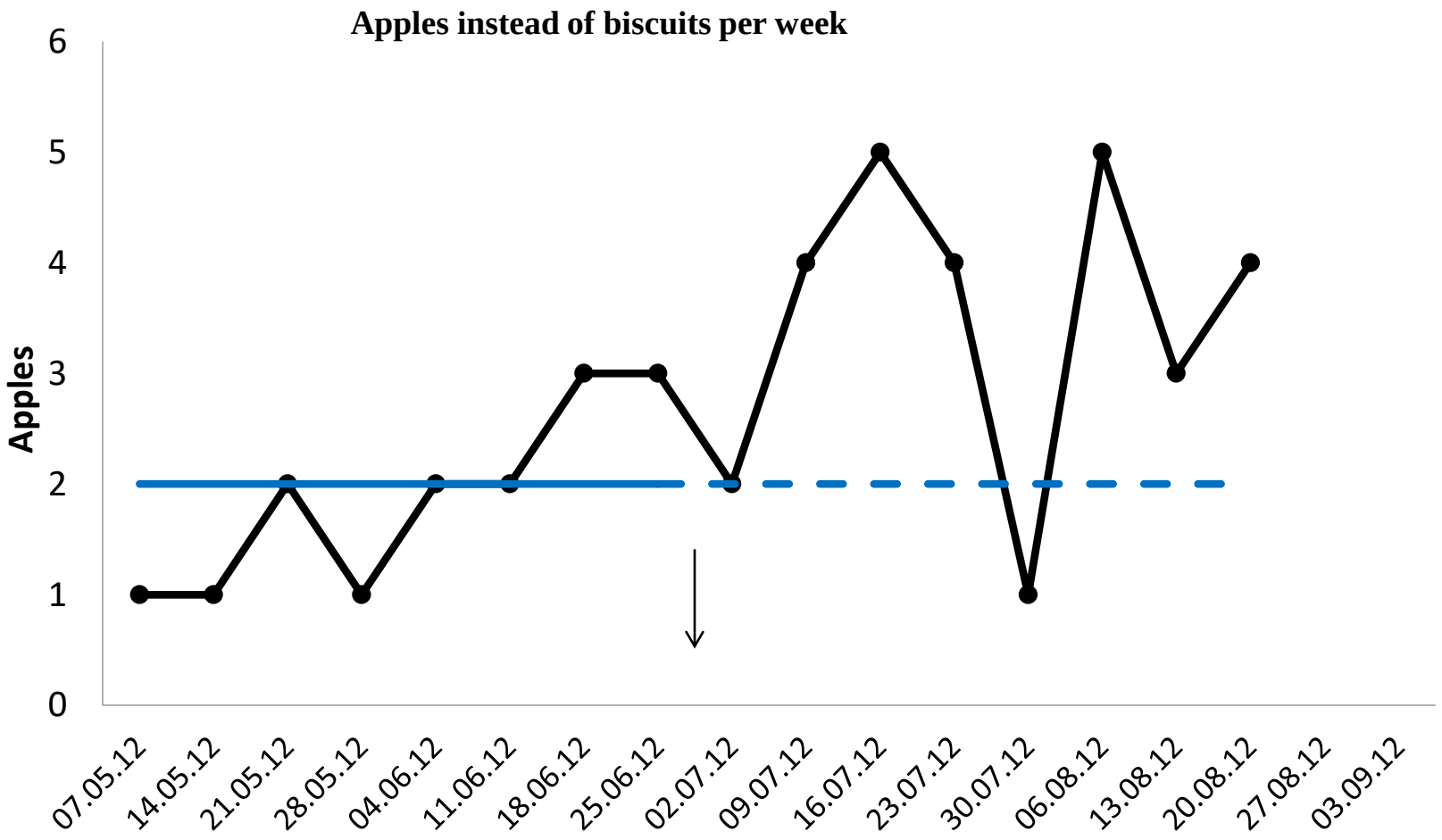


Second,
You need to determine the number of Runs

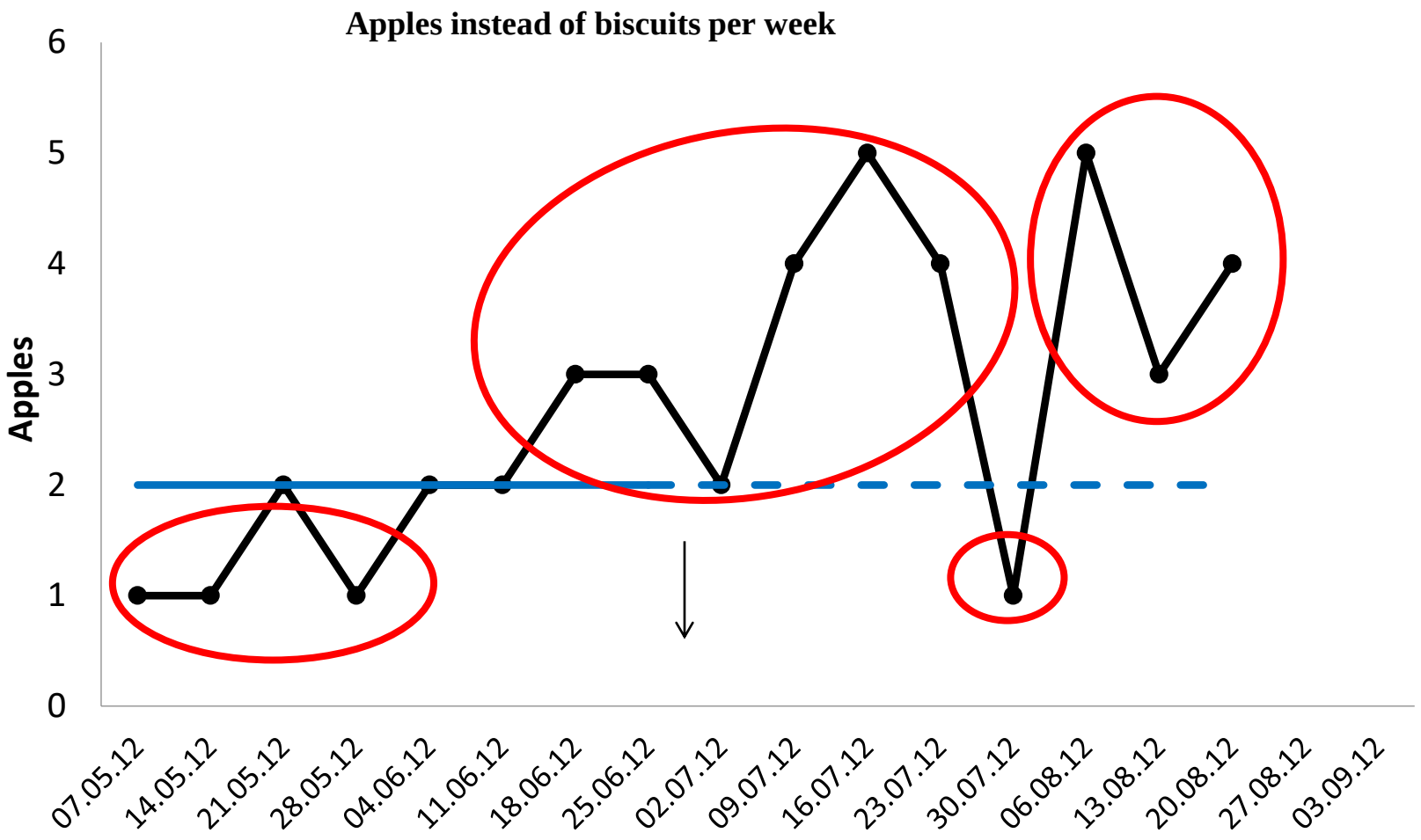
How do we count the number of runs?

- Draw a circle around each run and count the number of circles you have drawn

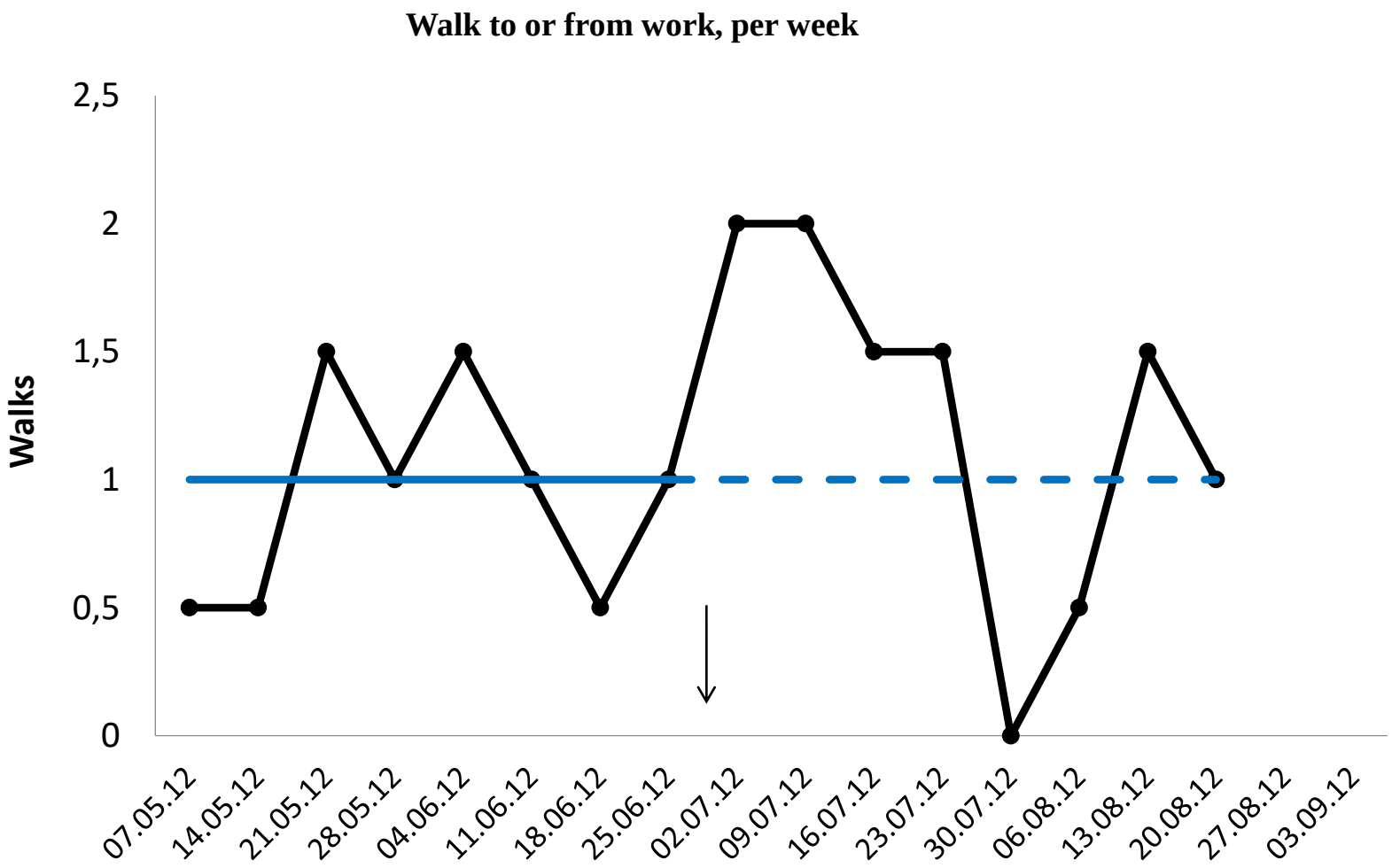
How many runs (1) ?



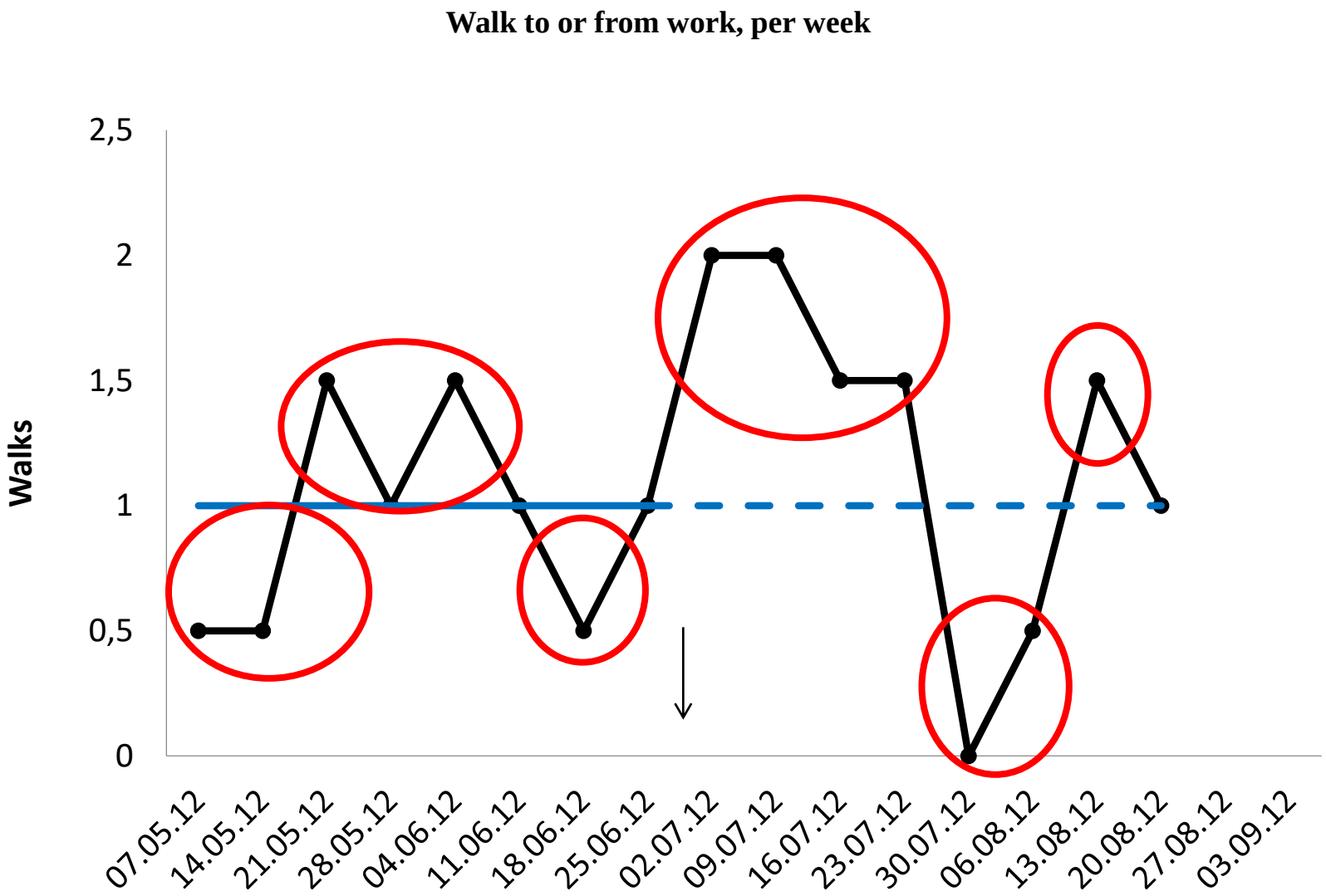
How many runs (1) ?



How many runs (2) ?



How many runs (2) ?

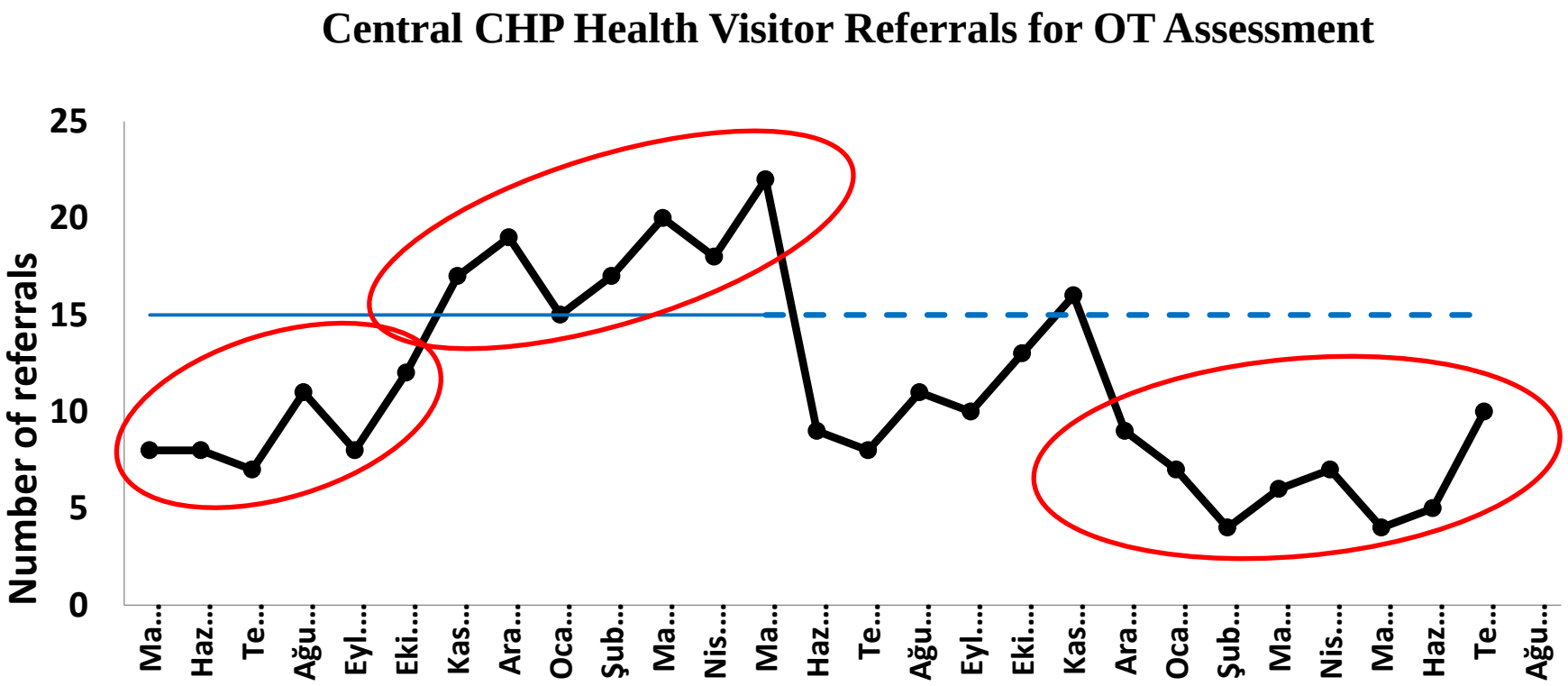


Run charts rules:

1. Shift
2. Trend
3. Runs (too many or too few)
4. Astronomical point

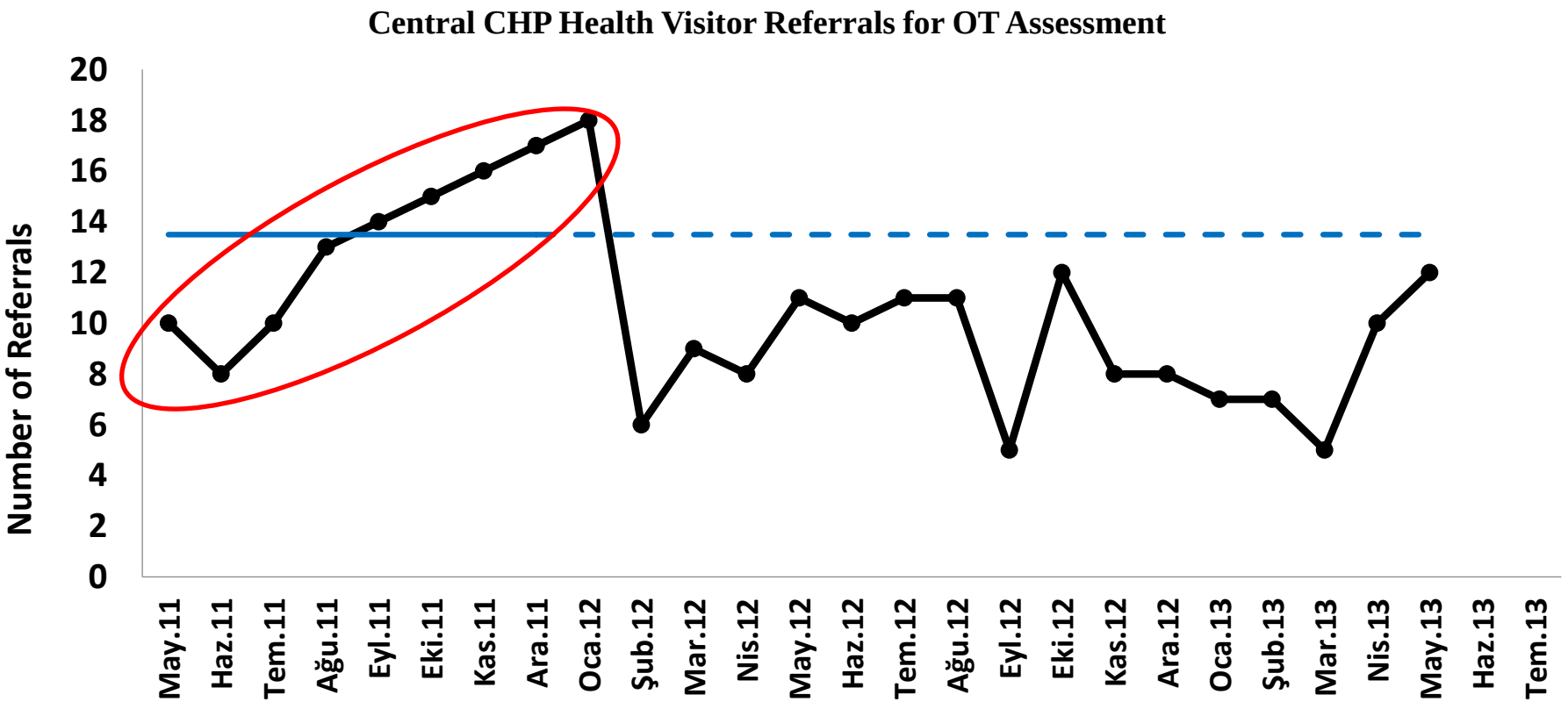
Run charts: Rule 1 – Shift

- Six or more data points in a run (all above or all below median)

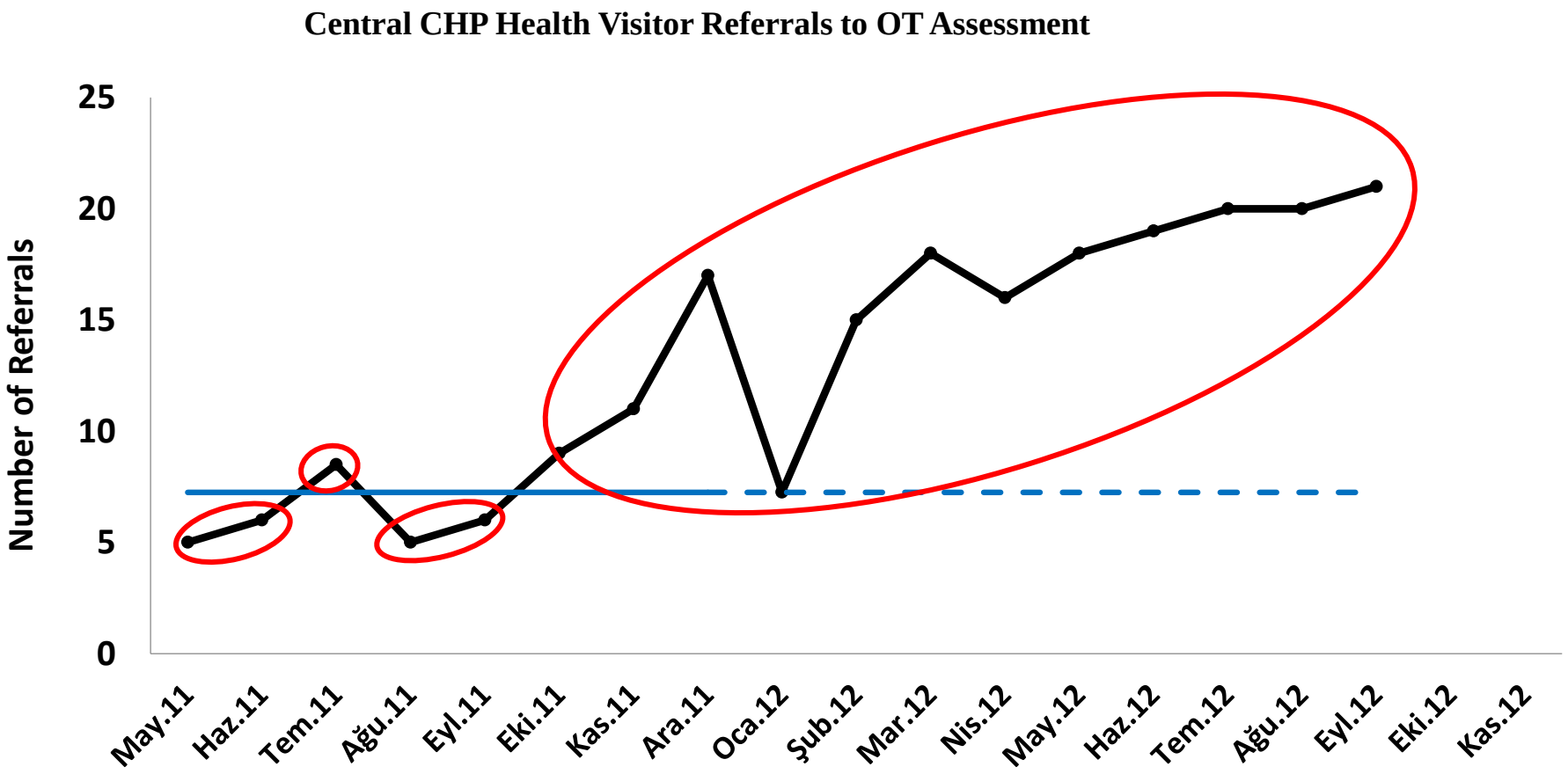


Run charts: Rule 2 – Trend

- Five or more consecutive data points all increasing or decreasing

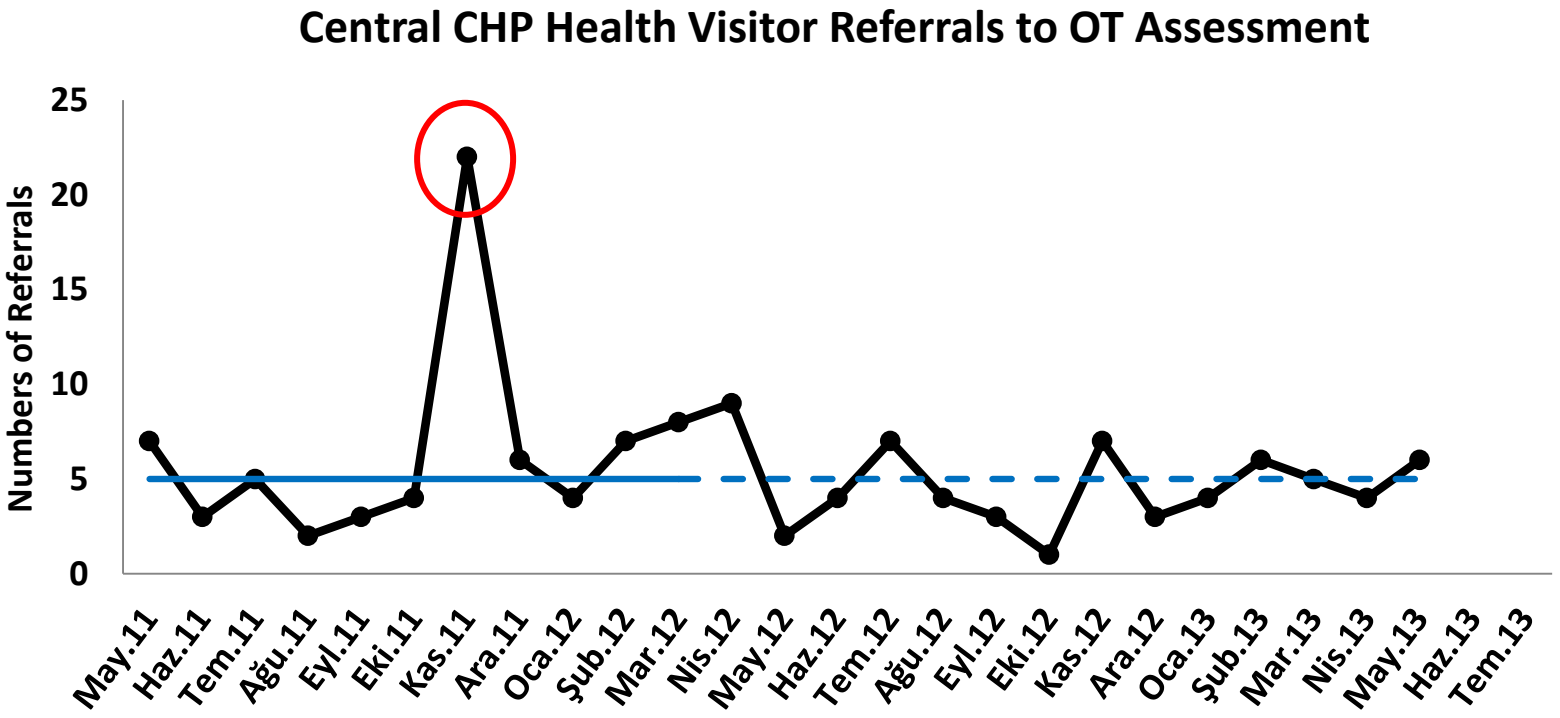


Run charts: Rule 3
Too few or too many runs



Run charts: Rule 4

- An ‘astronomical’ data point



Example 2: Run chart

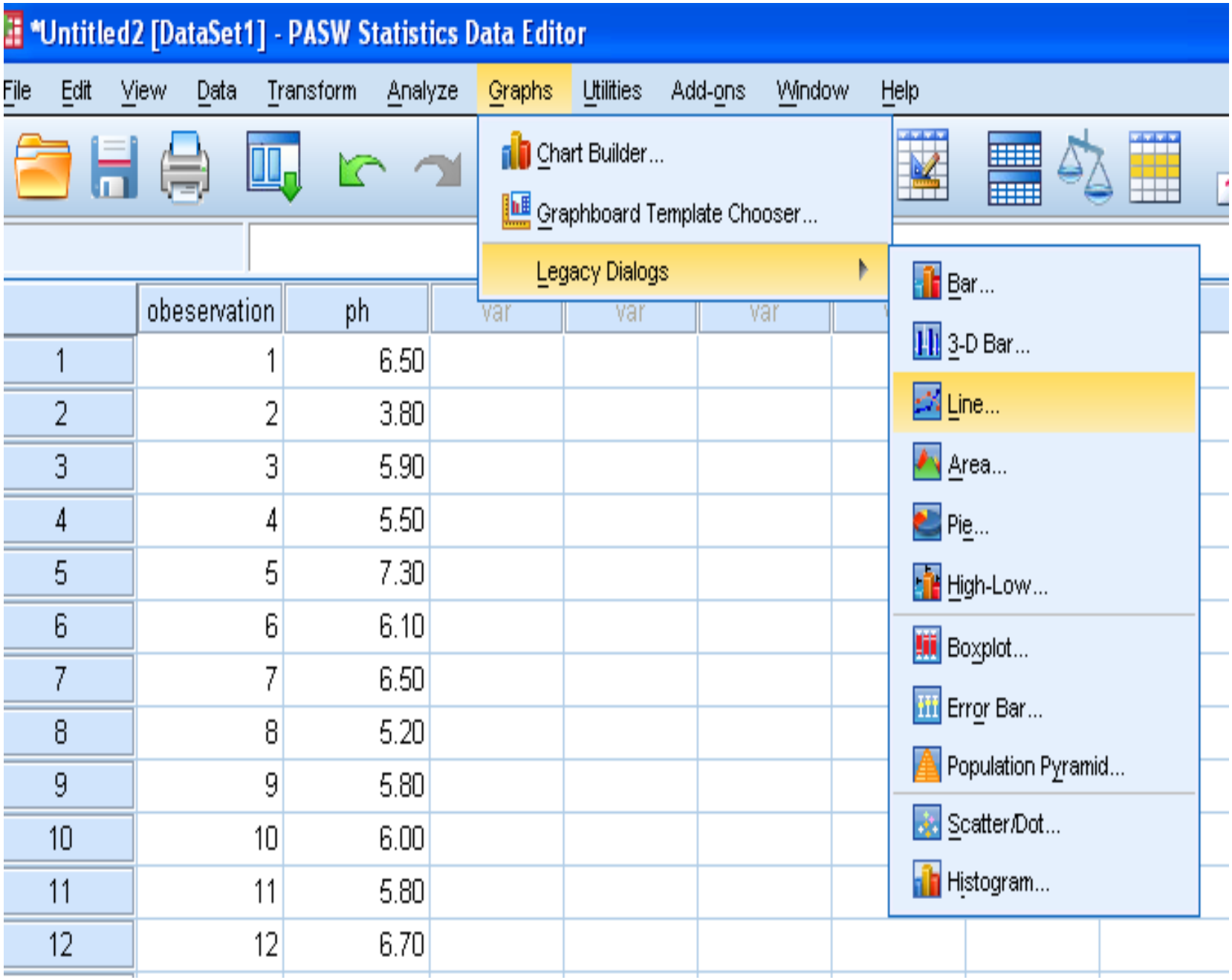
- Please enter the data shown below in to the SPSS:

observation	pH
1	6.5
2	3.8
3	5.9
4	5.5
5	7.3
6	6.1
7	6.5
8	5.2
9	5.8
10	6
11	5.8
12	6.7
13	6.6
14	6.8
15	7
16	6.6
17	5.5
18	5.2
19	5.2
20	4.8

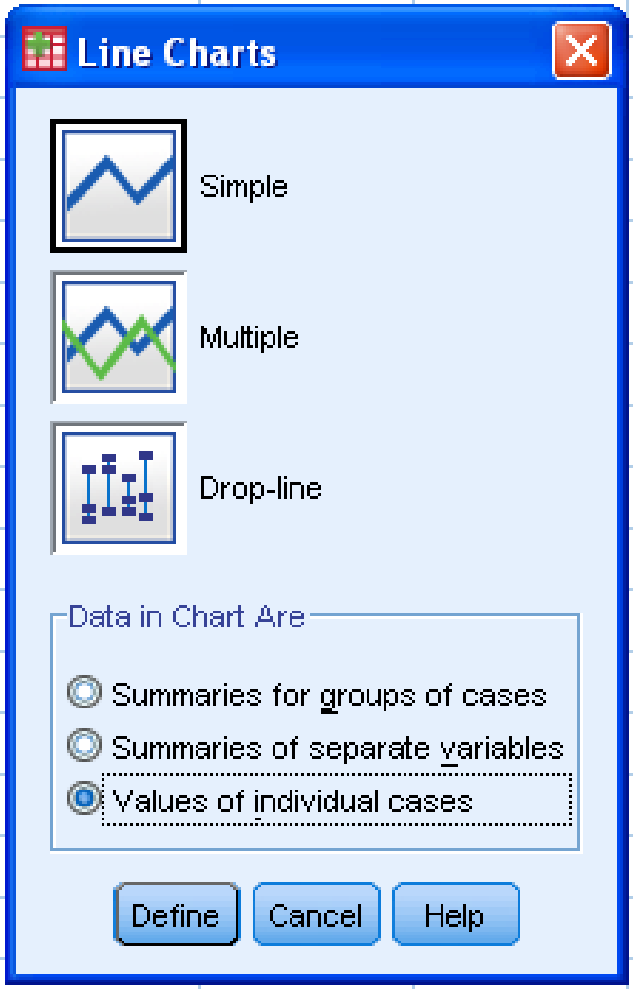
Variable view

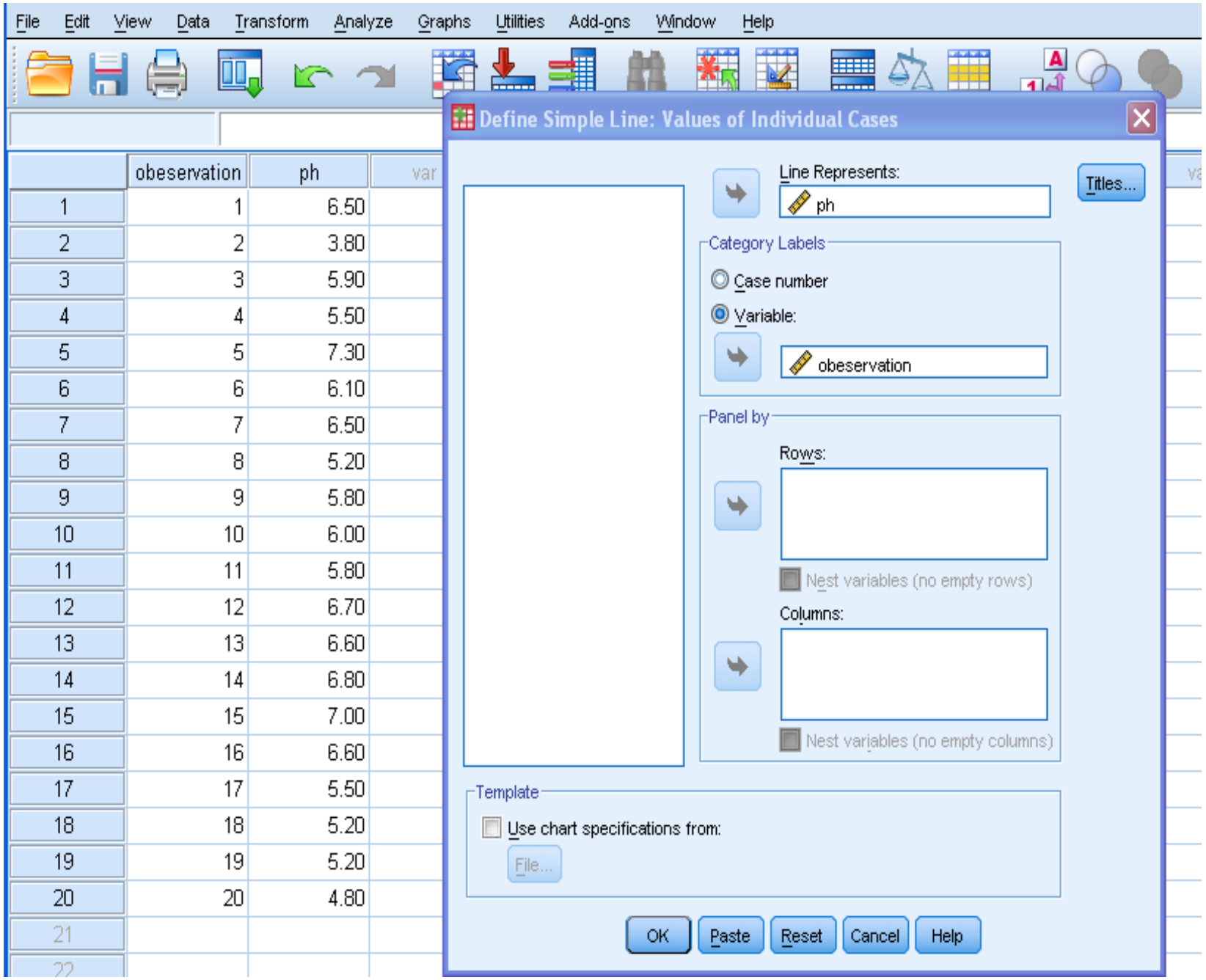
File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
1	observation	Numeric	8	0	observation number	None	None	8	Center	Scale
2	pH	Numeric	8	1	pH	None	None	8	Center	Scale
3										
4										
5										
6										
7										
8										


*Untitled2 [DataSet1] - PASW Statistics Data Editor
File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help
Chart Builder...
Graphboard Template Chooser...
Legacy Dialogs
Bar...
3-D Bar...
Line...
Area...
Pie...
High-Low...
Boxplot...
Error Bar...
Population Pyramid...
Scatter/Dot...
Histogram...
obeservation
ph
var
1 1 6.50
2 2 3.80
3 3 5.90
4 4 5.50
5 5 7.30
6 6 6.10
7 7 6.50
8 8 5.20
9 9 5.80
10 10 6.00
11 11 5.80
12 12 6.70

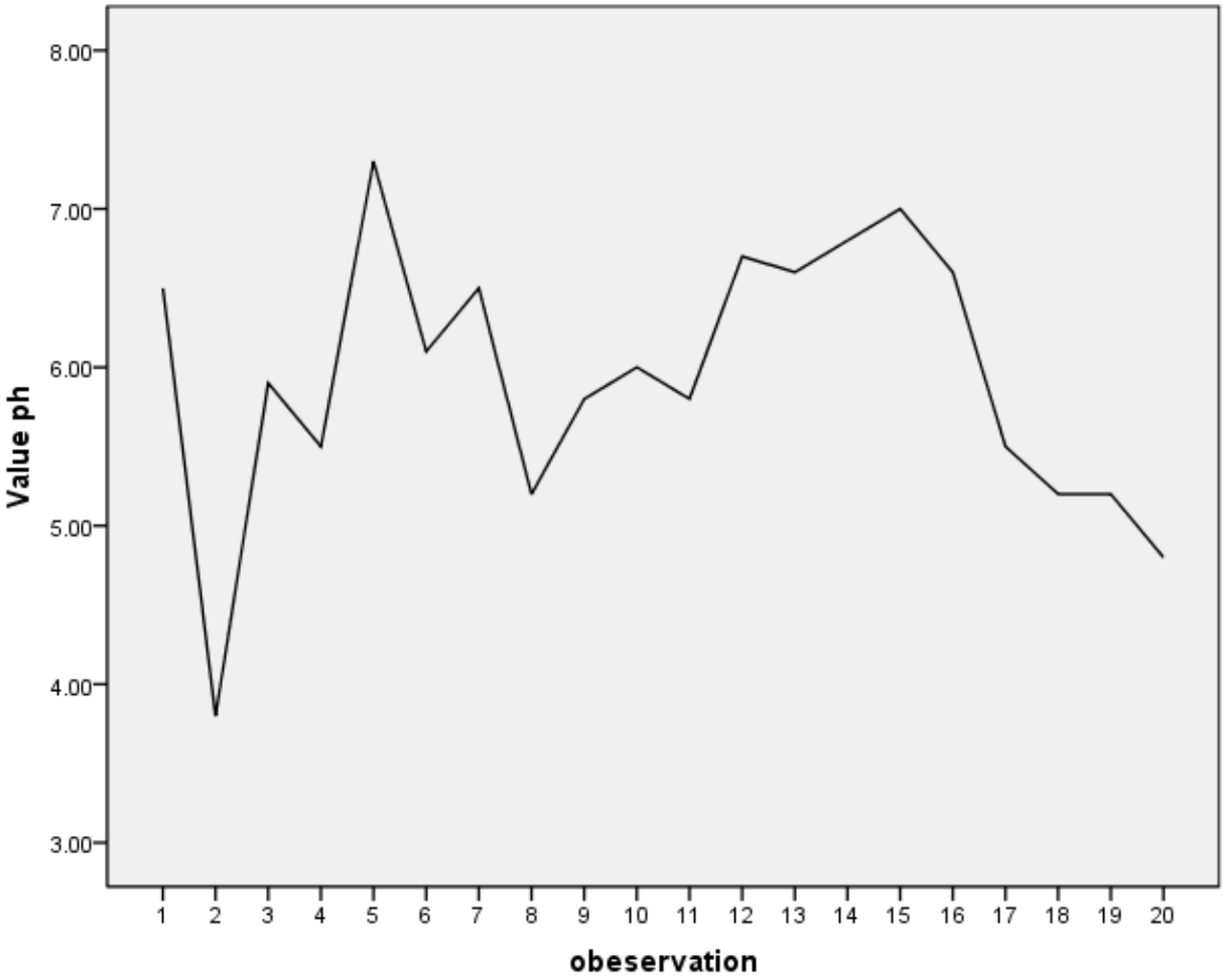
obeservation	ph	var	var	var	var	var
1	6.50					
2	3.80					
3	5.90					
4	5.50					
5	7.30					
6	6.10					
7	6.50					
8	5.20					
9	5.80					
10	6.00					
11	5.80					
12	6.70					
13	6.60					
14	6.80					
15	7.00					
16	6.60					
17	5.50					
18	5.20					
19	5.20					





	obeservation	ph	var
1	1	6.50	
2	2	3.80	
3	3	5.90	
4	4	5.50	
5	5	7.30	
6	6	6.10	
7	7	6.50	
8	8	5.20	
9	9	5.80	
10	10	6.00	
11	11	5.80	
12	12	6.70	
13	13	6.60	
14	14	6.80	
15	15	7.00	
16	16	6.60	
17	17	5.50	
18	18	5.20	
19	19	5.20	
20	20	4.80	
21			
22			

Run chart for acidity



Cross Tabulate

- Crosstabs is an **SPSS** procedure that **cross-**tabulates two variables, thus displaying their relationship in tabular form.

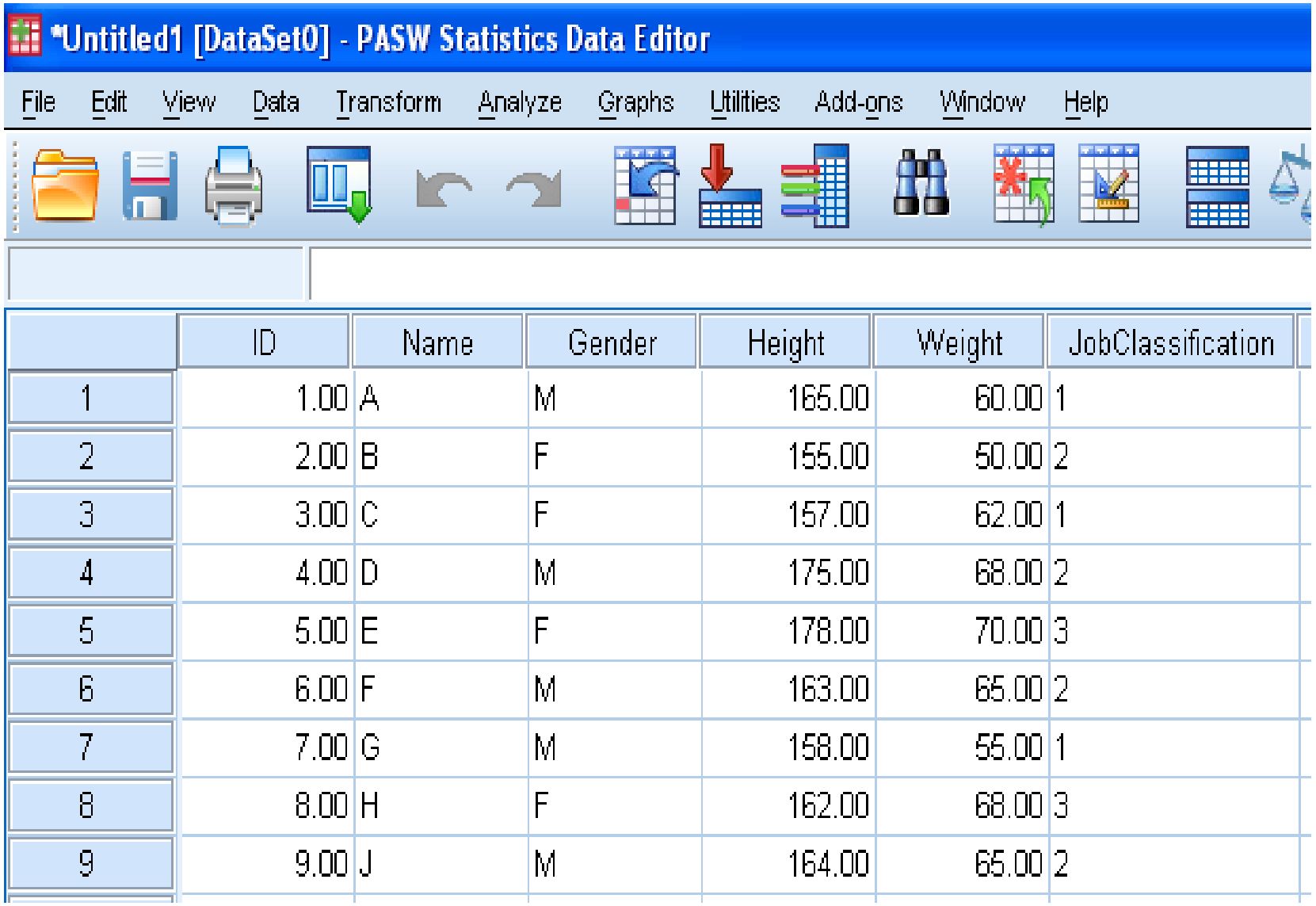
- In contrast to Frequencies, which summarizes information about one variable, Crosstabs generates information about bivariate relationships.

Example 3 : Cross Tabulate

Please check the relationship between the gender and the job classification in the following data.

ID	Name	Gender	Height	Weight	Job Classification
1	A	M	165	60	Job Type 1
2	B	F	155	50	Job Type 2
3	C	F	157	62	Job Type 1
4	D	M	175	68	Job Type 2
5	E	F	178	70	Job Type 3
6	F	M	163	65	Job Type 2
7	G	M	158	55	Job Type 1
8	H	F	162	68	Job Type 3
9	J	M	164	65	Job Type 2

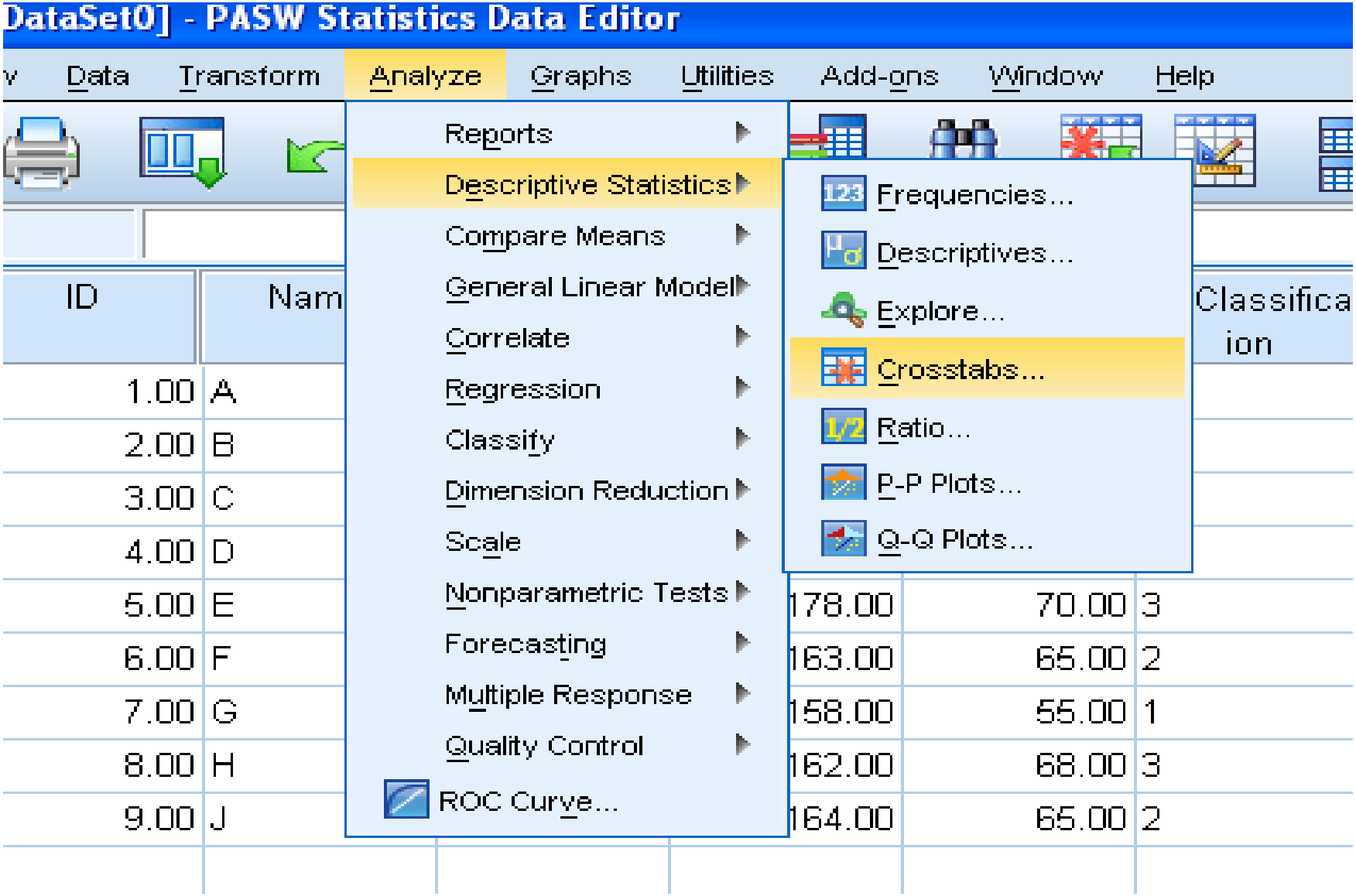
Data View

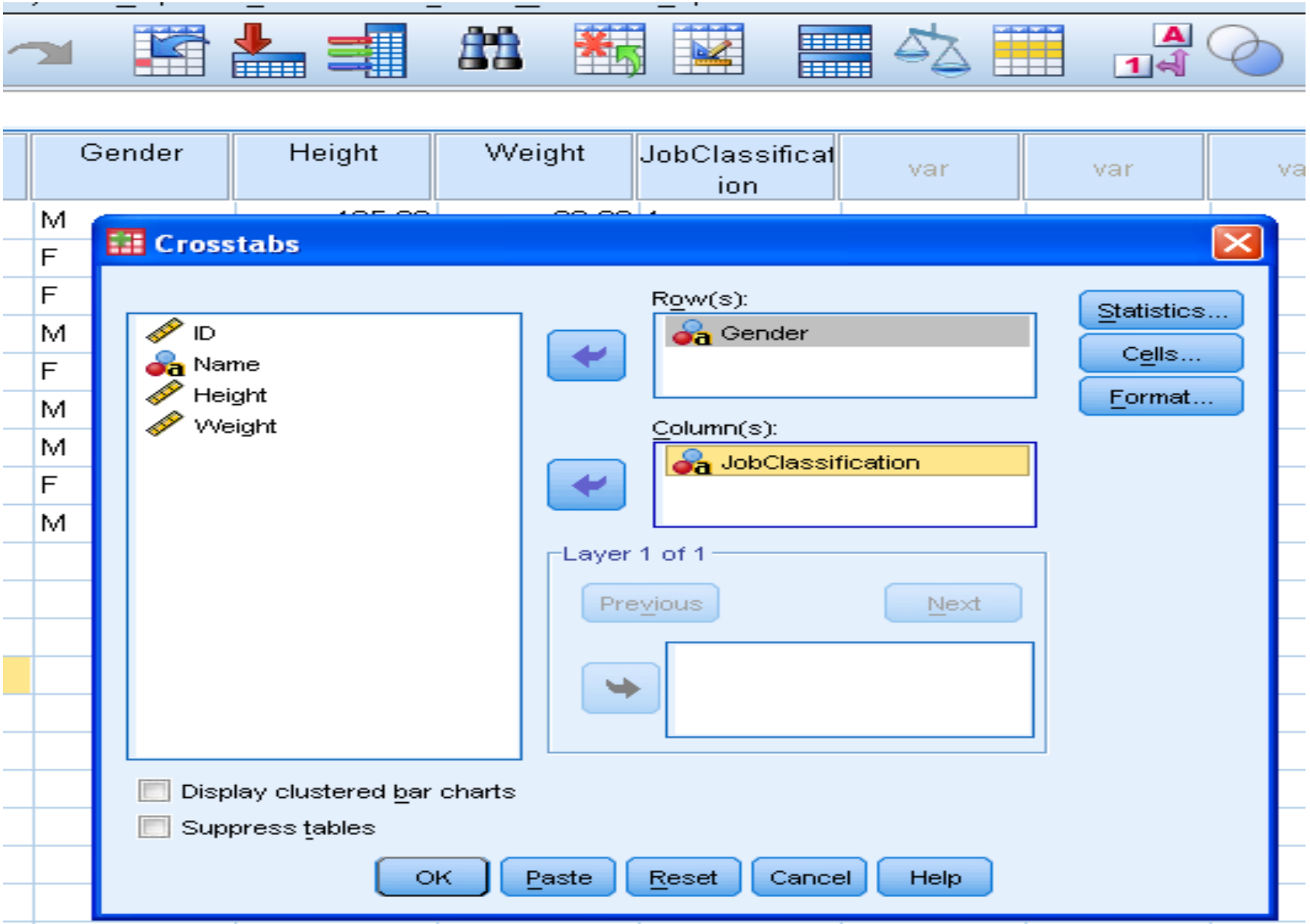


	ID	Name	Gender	Height	Weight	JobClassification
1	1.00	A	M	165.00	60.00	1
2	2.00	B	F	155.00	50.00	2
3	3.00	C	F	157.00	62.00	1
4	4.00	D	M	175.00	68.00	2
5	5.00	E	F	178.00	70.00	3
6	6.00	F	M	163.00	65.00	2
7	7.00	G	M	158.00	55.00	1
8	8.00	H	F	162.00	68.00	3
9	9.00	J	M	164.00	65.00	2

Variable View

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
1	ID	Numeric	8	2		None	None	8	Right	Scale
2	Name	String	8	0		None	None	8	Left	Nominal
3	Gender	String	8	0		{F, Female}...	None	8	Left	Nominal
4	Height	Numeric	8	2		None	None	8	Right	Scale
5	Weight	Numeric	8	2		None	None	8	Right	Scale
6	JobClassific...	String	8	0		{1, Job Type...	None	8	Left	Nominal
7										


DataSet0] - PASW Statistics Data Editor
v Data Transform Analyze Graphs Utilities Add-ons Window Help
Reports
Descriptive Statistics
Compare Means
General Linear Model
Correlate
Regression
Classify
Dimension Reduction
Scale
Nonparametric Tests
Forecasting
Multiple Response
Quality Control
ROC Curve...
Frequencies...
Descriptives...
Explore...
Crosstabs...
Ratio...
P-P Plots...
Q-Q Plots...
ID
Nam
Classifica
ion
1.00 A
2.00 B
3.00 C
4.00 D
5.00 E 178.00 70.00 3
6.00 F 163.00 65.00 2
7.00 G 158.00 55.00 1
8.00 H 162.00 68.00 3
9.00 J 164.00 65.00 2


Gender
Height
Weight
JobClassificat ion
var
var
M
F
F
M
F
M
M
F
M
Crosstabs
ID
Name
Height
Weight
Row(s):
Gender
Column(s):
JobClassification
Statistics...
Cells...
Format...
Layer 1 of 1
Previous
Next
Display clustered bar charts
Suppress tables
OK
Paste
Reset
Cancel
Help

Gender * JobClassification Crosstabulation

Count

		JobClassification			
		Job Type 1	Job Type 2	Job Type 3	Total
Gender	Female	1	1	2	4
	Male	2	3	0	5
Total		3	4	2	9

THANKS FOR YOUR ATTENTION

- For further information :

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