Table 1. **Covariance**, s_{xy} $$s_{xy} = \frac{\Sigma(X_i - M_x)(Y_i - M_y)}{n-1}$$

Where, M_x and M_y are means of X and Y variables respectively

X_i	Y_i	$X_i - M_x$	$Y_i - M_y$	$(X_i - M_x)(Y_i - M_y)$
2	49	-1	-1	1
5	56	2	6	12
1	40	-2	-10	20
3	53	0	3	0
4	53	1	3	3
1	37	-2	-13	26
5	62	2	12	24
3	47	0	-3	0
4	58	1	8	8
2	45	-1	-5	5
2	49	-1	-1	1
M_x = 3	*M_y = 50*	*Sum = 0*	*Sum = 0*	*Sum = 99*

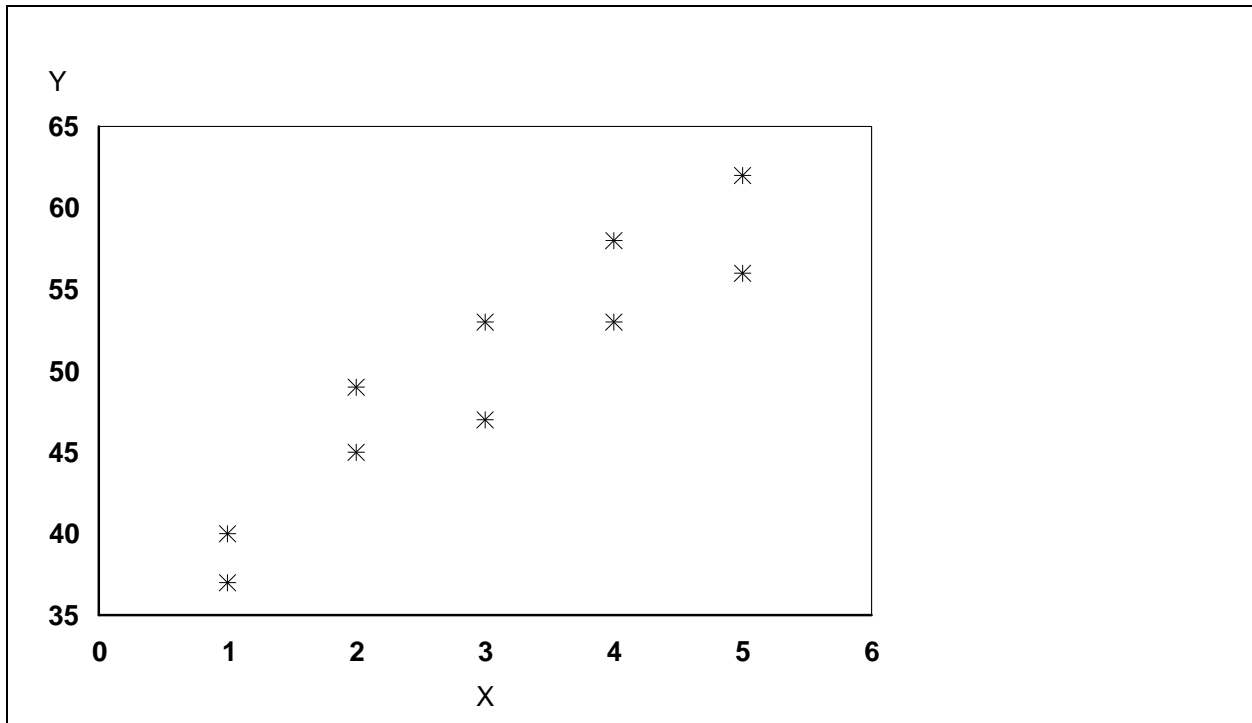$$s_{xy} = \frac{\Sigma(X_i - M_x)(Y_i - M_y)}{n-1} = \frac{99}{9} = 11$$

Figure 1. Scattered plot using document chart option.

Correlation Coefficient, *r*

Pearson Product Moment Correlation Coefficient or *sample correlation coefficient*, r

$$r_{xy} = r = \frac{s_{xy}}{s_x s_y},$$

where

        r_{xy} = sample correlation coefficient,
        s_{xy} = sample covariance,
        s_x = sample standard deviation of x, and
        s_y = sample standard deviation of y

A computational formula for *r* is:

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{N\sum X^2 - (\sum X)^2} \cdot \sqrt{N\sum Y^2 - (\sum Y)^2}}$$

Table 2. **Sample Correlation Coefficient**,

X_i	Y_i	X^2	Y^2	XY
2	49	4	2401	98
5	56	25	3136	280
1	40	1	1600	40
3	53	9	2809	159
4	53	16	2809	212
1	37	1	1369	37
5	62	25	3844	310
3	47	9	2209	141
4	58	16	3364	232
2	45	4	2025	90
$\sum X = 30$	$\sum Y = 500$	$\sum X^2 = 110$	$\sum Y^2 = 25566$	$\sum XY = 1599$

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{N\sum X^2 - (\sum X)^2} \cdot \sqrt{N\sum Y^2 - (\sum Y)^2}} = \frac{10(1599) - (30)(500)}{\sqrt{10(110) - 30^2} \cdot \sqrt{10(25566) - 500^2}}$$

$$r = \frac{990}{1063.96} = 0.93$$

So the Pearson *r* or sample correlation coefficient is 0.93 and since 0.93 > 0.80 there is a strong positive correlation or linear association between both variables.

The **Coefficient of Determination**, r^2 is 0.93^2 = **0.8649** or 86.49% of the variation in Y is associated with change in X; i.e. 13.51% is caused by other factors.
SPSS outputs

Table 3. **Descriptive Statistics Table**

SPSS Procedure: Analyze -> **Descriptive Statistics** - Select X and Y variables and for **Statistics** Select Mean, Sum and Std Dev.

		X	Y
N	Valid	10	10
Mean		3.0000	50.0000
Std. Deviation		1.49071	7.93025
Sum		30.00	500.00

Table 4. **Correlation Table**

See SPSS Correlation figure on next page.

The *sample correlation coefficient* is **0.93** and *sample covariance* is **11**.

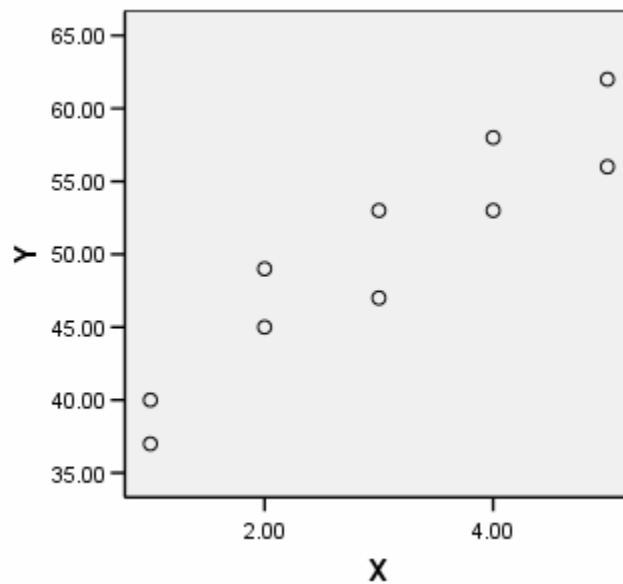|		Y
X	Pearson Correlation	.930(**)
	Sig. (2-tailed)	.000
	Sum of Squares and Cross-products	99.000
	Covariance	11.000
	N	10

** Correlation is significant at the 0.01 level (2-tailed).
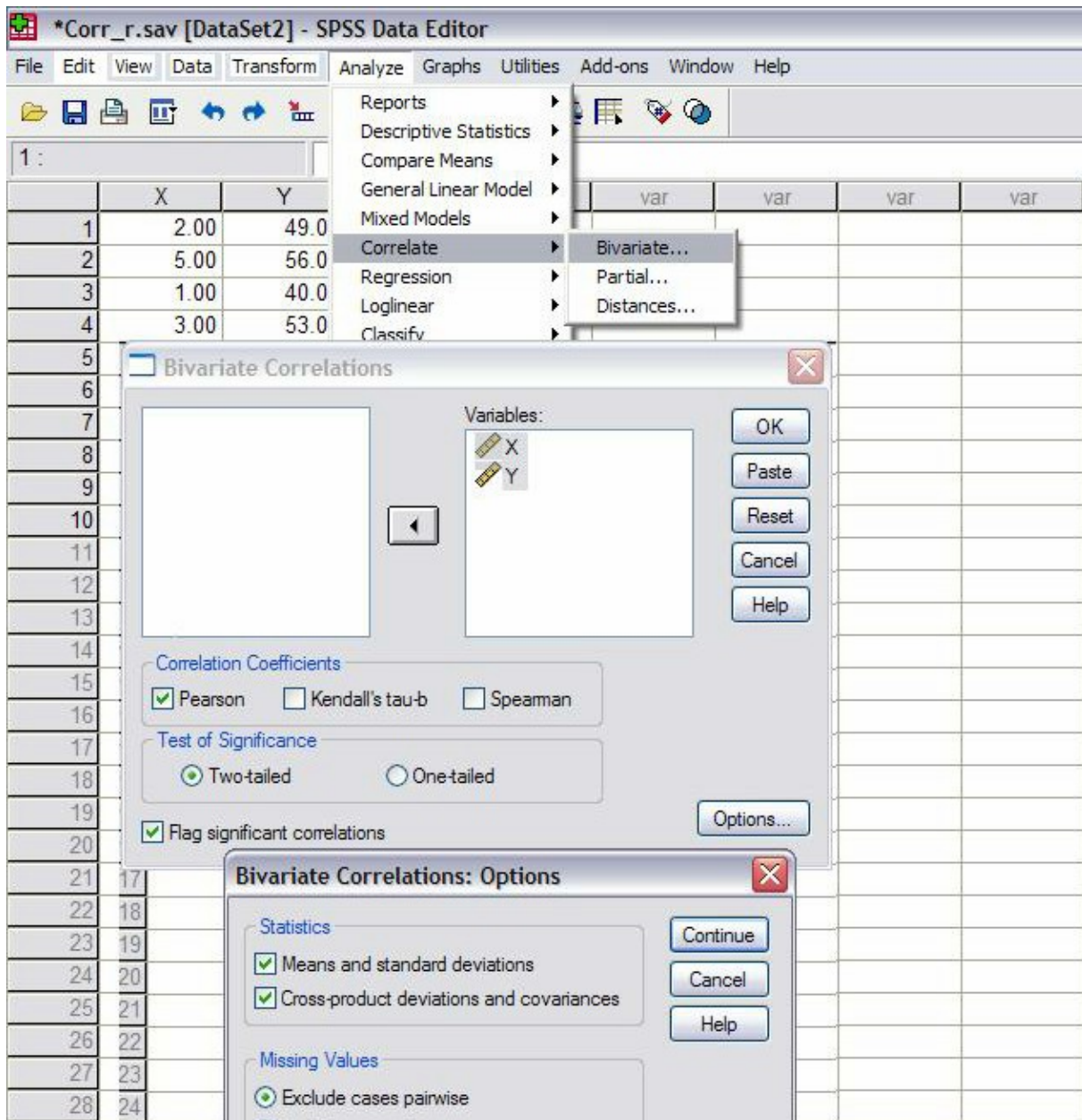

Figure 2. SPSS: Scatter plot
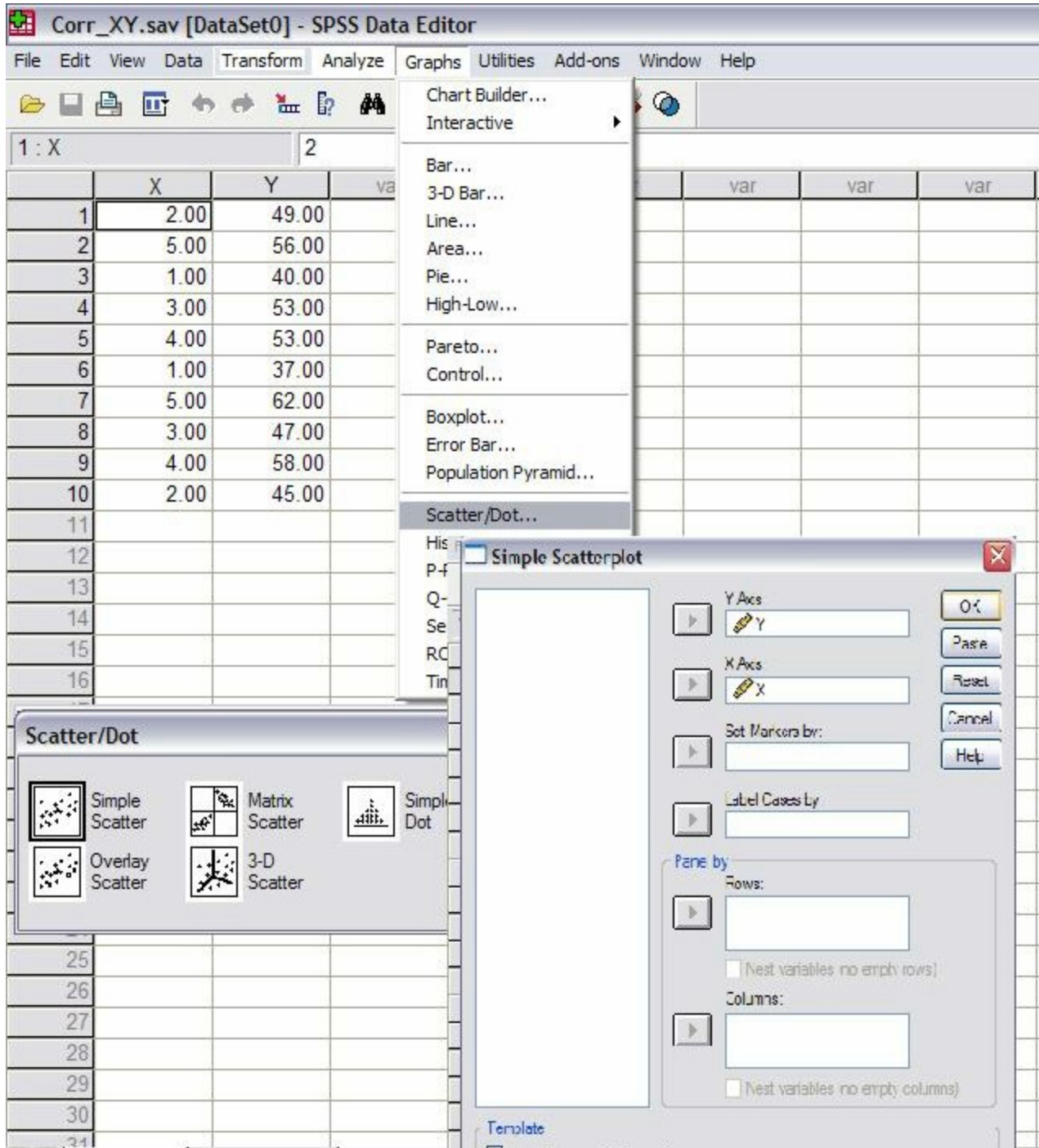
Figure 3. SPSS: Correlation procedure

Figure 4. SPSS: Scatter plot procedures.

To draw a scatter plot using SPSS do the following: **Graph** -> **Scatter/Dot** -> **Simple Scatter** -> Select variables. A figure of the SPSS procedure is shown below.