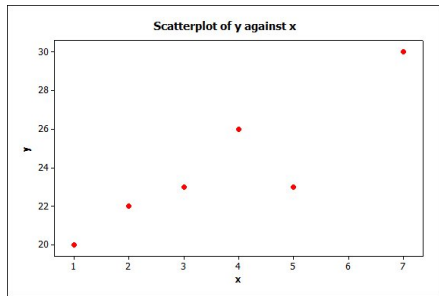


ACE2013: Statistics for Marketing and Management: Supplementary handout 1

x	2	5	1	4	7	3
y	22	27	20	26	30	23



- Describe, in words, the relationship between x and y:

There is a **strong/moderate/weak, positive/negative linear/non-linear** association between x and y (delete as appropriate).

- Estimate the correlation coefficient r between x and y, and then, using Minitab (or otherwise), calculate this value:

Estimate **Calculated value**

$r =$ _____ $r =$ _____

- Use Minitab to perform a hypothesis test for the population correlation coefficient ρ :

H_0 : _____

H_1 : _____

p -value = _____

Conclusion

- No/slight/moderate/strong** evidence against H_0 .
- We should therefore **retain/reject** H_0 .

- Is it worth performing a regression analysis to obtain the equation of the regression line? **Yes/No**. If Yes:

- Use Minitab to obtain the estimated regression line:

$$Y = \beta_0 + \beta_1 X + \varepsilon, \varepsilon \sim N(0, \sigma^2)$$

$$= \text{___} + \text{___}X + \varepsilon, \varepsilon \sim N(0, \text{___}^2)$$

- Perform a hypothesis test for the slope term β_1 :

H_0 : _____

H_1 : _____

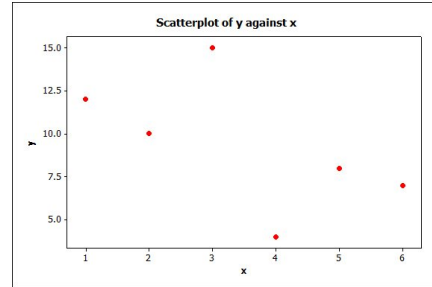
p -value = _____

Conclusion

- No/slight/moderate/strong** evidence against H_0 .
- We should therefore **retain/reject** H_0 .

- Comment on the R^2 Statistic:

x	1	2	3	4	5	6
y	12	10	15	4	8	7



- Describe, in words, the relationship between x and y:

There is a **strong/moderate/weak, positive/negative linear/non-linear** association between x and y (delete as appropriate).

- Estimate the correlation coefficient r between x and y and then calculate this value:

Estimate **Calculated value**

$r =$ _____ $r =$ _____

- Use Minitab to perform a hypothesis test for the population correlation coefficient ρ :

H_0 : _____

H_1 : _____

p -value = _____

Conclusion

- No/slight/moderate/strong** evidence against H_0 .
- We should therefore **retain/reject** H_0 .

- Is it worth performing a regression analysis to obtain the equation of the regression line? **Yes/No**. If Yes:

- Use Minitab to obtain the estimated regression line:

$$Y = \beta_0 + \beta_1 X + \varepsilon, \varepsilon \sim N(0, \sigma^2)$$

$$= \text{___} + \text{___}X + \varepsilon, \varepsilon \sim N(0, \text{___}^2)$$

- Perform a hypothesis test for the slope term β_1 :

H_0 : _____

H_1 : _____

p -value = _____

Conclusion

- No/slight/moderate/strong** evidence against H_0 .
- We should therefore **retain/reject** H_0 .

- Comment on the R^2 Statistic:

Exam-style question

The Wall's Ice Cream Group (the UK's largest producer of ice cream) believe sales are influenced by outside temperature. To investigate, in 2009 their team of market analysts recorded total monthly sales (Y , in millions of pounds) and the average UK monthly temperature ($X^{\circ}\text{C}$). Some summaries are shown below:

$$\sum_{i=1}^{12} x_i = 120 \quad \sum_{i=1}^{12} y_i = 1193 \quad \sum_{i=1}^{12} x_i^2 = 1450 \quad \sum_{i=1}^{12} y_i^2 = 128997 \quad \sum_{i=1}^{12} x_i y_i = 13086$$

- (a) Use the summaries give above to calculate the sample correlation coefficient, and comment.
- (b) The team of analysts decided to perform a simple linear regression of Y on X to model the relationship between temperature and sales. The resulting (edited) output from **Minitab** for this simple linear regression model is shown below; look at it, and then answer the following questions.

Regression Analysis: Sales (£000) versus Average temperature				
The regression equation is				
Sales (£000) =		+		Average temperature
Predictor	Coef	SE Coef	T	P
Constant			3.40	0.007
Average temperature		1.421		0.009
S = 22.4668	R-Sq = %	R-Sq(adj) = 46.6%		

- (i) Use the summaries given above, your answer to part (a) and the information already shown in the **Minitab** output to complete the regression equation and the regression table.
- (ii) In your solutions, write down the full estimated regression model.
- (iii) Test the significance of the slope term, making sure you clearly state your null and alternative hypotheses.
- (iv) Interpret the value of **R-Sq** in the above output.
- (v) State the assumptions underlying the regression model that has been fitted here.
- (c) The average temperature this July in the UK is forecast to be 21°C . Using the output given above, predict sales of ice cream for Walls in July.
- (d) Find an estimate of the average temperature in November 2009, given that sales were recorded as £81M.