



SEPTEMBER 2017

QUANTITATIVE METHODS FOR MANAGERS

Instructions to candidates:

- a) Time allowed: Three hours (plus an extra ten minutes' reading time at the start – do not write anything during this time)
 - b) Answer any FIVE questions
 - c) All questions carry equal marks. Marks for each question are shown in []
 - d) Non-programmable calculators are permitted in this examination
1. a) Using a simple example, briefly explain how index numbers can be of assistance to managers. [5]
b) The following table shows the number of employees in each of the four departments of a medium-sized commercial organisation, along with their median annual salaries, for the years 2010 and 2016:

	2010		2016	
	Number Employed	Average Salary (£)	Number Employed	Average Salary (£)
Production	110	16,000.00	100	21,000.00
Marketing	30	21,000.00	20	26,200.00
Administrative	20	18,200.00	15	23,000.00
Personnel	10	35,200.00	10	50,300.00

Calculate the appropriate Laspeyres index which will enable you to compare the median salaries of the employees between the years 2010 and 2016. [10]

- c) Briefly comment on your answer to part (b). [5]
2. New Age Fashions has recorded the sales values of its various product lines made during a particular day, and the results are given in the following table:

Value of Sales (£)	Number of Sales
Less than 20	12
20 - 40	34
40 - 60	88
60 - 80	40
80 - 100	18
More than 100	8

- a) Draw a histogram to represent this data, and comment on its shape. [5]
b) Calculate the mean value of the sales. [3]
c) Calculate the standard deviation of the sales. [7]
d) If the coefficient of variation of a competitor is 35%, briefly comment on the performance of the two companies. [5]
3. The weekly demand for a wood preservative that is marketed by a large garden centre is normally distributed with a mean of 5,000 litres and a standard deviation of 800 litres.
- a) What is the probability that in a particular week, the demand will be more than 5,800 litres? [5]
b) What is the probability that in a particular week, the demand will be between 4,600 and 5,400 litres? [7]
c) How many litres of the product must the centre have in stock at the start of a week to have only a risk of 0.05 of running out of stock in that week? [8]

continued overleaf

4. A car financing company wishes to determine the mean annual income of its account holders. A random sample of 100 account holders was selected and the sample mean income was £28,000 with a standard deviation of £5,000.
- Construct a 99% confidence interval for the true mean income. [5]
 - How large a sample should be selected so that the company can be 95% confident that the true mean and the sample mean should differ by at most £500? [10]
 - If 20 members of the original sample had defaulted on a monthly repayment, estimate with 95% confidence, the true proportion of account holders that had defaulted on a payment. [5]
5. The personnel manager of an organisation wishes to analyse the relationship between the age of its employees and their sickness records. A randomly selected sample of 100 of its employees yielded the following results:

Person	Age	Days off because of sickness
A	22	14
B	17	21
C	37	10
D	56	5
E	21	14
F	21	16
G	43	8
H	40	9
I	32	11
J	29	12

- Plot a suitably labelled scatter diagram for the above data, and briefly comment on its pattern. [3]
 - Calculate the correlation coefficient, and briefly comment on its value. [10]
 - The equation of the regression relationship between days off sick and age is:

$$\text{Days off sick} = 22.91 - 0.34 \times \text{Age}$$
Briefly explain the practical meaning of the value 22.91 in this equation. [5]
 - Predict the number of days off because of sickness for a 60-year-old employee. [2]
6. The following table shows how the sales (£m) of a large UK-based manufacturing company were broken down between the company's four sales regions between the years 2012 to 2016:

Sales Region	2012	2013	2014	2015	2016
England	5.0	3.0	3.2	4.6	4.7
N. Ireland	7.0	5.9	3.5	4.2	4.7
Scotland	8.6	10.1	6.2	5.3	5.2
Wales	2.5	2.4	2.4	2.5	2.6
Totals	23.1	21.4	15.3	16.6	17.2

- Draw a simple line graph showing how the total sales have changed over the five-year period. [3]
- Draw a multiple bar chart to compare the annual sales for the four regions. [6]
- Draw a pie chart to show the breakdown of total sales in 2016. [6]
- What can you conclude about the sales of this company? [5]

7. A builders' merchant is compiling its sales report for the last year (50 weeks). The following table shows the weekly sales (units) of a particular type of fencing panel over the period under consideration:

52	48	51	72	40
41	37	49	37	46
58	35	70	61	39
69	45	54	64	51
68	47	53	76	56
74	31	49	54	61
31	49	78	49	51
52	50	63	63	80
67	57	81	51	36
43	51	48	64	47

- Using the class intervals 30-40, 40-50, 50-60, etc. produce a frequency distribution of the weekly sales. [5]
- Draw a correctly labelled Ogive. [5]
- Use the Ogive to estimate the Median and Quartile Deviation of the weekly sales. [5]
- Use the Ogive to estimate the proportion of time that the weekly sales fall between 50 and 65 units. [5]

8. The following information is extracted from a project to develop a new shopping mall:

Activity	Duration (weeks)	Predecessors
A	6	---
B	5	---
C	7	---
D	3	B
E	5	A
F	4	C
G	5	E
H	2	D
I	7	F
J	2	G,H, I
K	3	J

- Construct a network diagram for the project. [10]
- Calculate the scheduled completion time and identify the critical path. [6]
- Calculate the total float for ALL activities. [4]