



SEPTEMBER 2015

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) An internet service provider is reconsidering its pricing structures with the aim of remaining competitive with similar service providers. In order to gain some idea of how long people spend using the internet at off-peak times during a week, a sample of 400 customers is randomly selected. The weekly usage of the sample had a mean of 200 minutes, and a standard deviation of 50 minutes. Use this sample information to estimate with 95% confidence, the true mean off-peak weekly usage time. [5]
- b) How large a sample would be required to be 90% confident that the true mean off-peak weekly usage time will differ from the sample mean by at most 5 minutes? [10]
- c) In the same sample, 300 of the customers indicated that they preferred to use the 'Moodle' search engine. Use this sample information to estimate with 95% confidence, the true proportion of customers using the 'Moodle' search engine. [5]
2. A builders' merchant is considering stocking a new range of water-based paint. The paint is sold in 2.5 litre cans, and it is estimated that the monthly demand for the paint will be approximately normally distributed with a mean of 1,500 cans and a standard deviation of 400 cans. What is the probability that during the first month, the demand will be:
- a) more than 2,000 cans? [5]
- b) between 1,600 cans and 2,000 cans? [8]
- c) It is intended to replenish the stock level of the paint at the start of each month. What should the replenishment level be so the probability of running out of stock will be less than 5%? [7]
3. The following table shows the daily amount spent (£) on newspapers at a branch of the newsagent W G Smyth in a local shopping mall over a five week period in 2014:
- |     |     |     |     |     |
|-----|-----|-----|-----|-----|
| 438 | 266 | 370 | 510 | 329 |
| 302 | 277 | 350 | 189 | 360 |
| 425 | 213 | 382 | 390 | 249 |
| 428 | 342 | 390 | 466 | 357 |
| 347 | 317 | 444 | 657 | 356 |
| 415 | 224 | 372 | 382 | 331 |
| 196 | 285 | 671 | 363 | 363 |
- a) Using the class intervals £100-£200, £200-£300, etc., produce a cumulative frequency distribution and ogive for the daily sales. [8]
- b) Obtain the median and inter-quartile range of the daily sales. [5]
- c) Estimate the percentage of days that sales were between £350 and £450. [4]
- d) Briefly explain the meanings of the measures found in part b). [3]

4. A haulage company wishes to determine the link between the distances covered (km) and the time taken (hours) by its vehicles from the depot to its customers throughout the country. A sample of ten journeys yielded the following results:

Distance (X)	Journey Time (Y)
200	3.2
120	2.0
175	3.0
150	2.0
300	4.7
320	5.5
240	3.8
180	2.8
210	3.4
260	4.5

- a) Present this information using a suitable scatter diagram, and briefly comment on its shape. [3]  
 b) Calculate the regression line of best fit for this data. [12]  
 c) A lorry is about to leave the depot for a journey of 90 km. Estimate the journey time of this lorry, and comment on the reliability of your estimate. [5]
5. A survey carried out into 600 small and medium-size companies (SMEs) throughout England yielded the following data on annual sales growth as a percentage of the previous year's growth during the recent recession:

**Annual Sales Growth (%)**

Region	No. of companies	2010	2011	2012
North	63	17.3	-1.0	2.5
South	143	21.1	3.2	2.4
East	77	11.9	7.6	0.6
West	48	50.5	25.5	-0.7
Outer London	78	17.3	1.7	2.3
Inner London	191	19.1	17.3	12.6

Plot the following charts:

- a) A pie chart showing the number of companies in EACH region. [6]  
 b) A line graph showing the average sales growth over the THREE years. [7]  
 c) A multiple bar chart comparing the sales growth for the regions over the THREE years. [7]

6. A marine engineering company is planning a project for the design and production of a new model of winch for a range of cabin cruisers and yachts. The following table shows information relating to the various tasks involved in this project:

Activity	Preceding Activities	Duration (weeks)
A	-	5
B	-	2
C	A	6
D	C	1
E	D	1
F	A,E	4
G	C	3
H	G	2
I	F,H,B	3

- a) Draw a network diagram for this project. [10]  
 b) Determine the project duration and the critical path. [6]  
 c) Produce a table showing the float for EACH activity. [2]  
 d) What will be the effect on the project duration if activities B and F are each delayed by 1 week? [2]
7. West End Fashions has recorded the sales made during a particular day, and the results are given in the following table:

Value of Sales (£)	Number of Sales
Less than 20	10
20 - 40	32
40 - 60	85
60 - 80	41
80 - 100	20
More than 100	12

- 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 40%, briefly comment on the performance of the two companies. [5]
8. A company is manufacturing caravan roof panels. Currently they have plans to produce a standard and a deluxe model of the panel. Due to expected demand, the production of the deluxe panel will be restricted to 9 per day. The following table shows the materials required by each unit, and the expected profit per unit:

	Standard	Deluxe
Resin	10kg	16kg
Glass Fibre	30m	50m
Profit	£50	£80

On any day, the availability of the raw materials will be restricted to 200kg of resin and 900m of glass fibre. The company wishes to determine the daily production mix that will maximise profit.

- a) Formulate the above information as a linear programming model. [10]  
 b) Using either a graphical or mathematical method, determine how many of each model of roof panel should be produced each day for maximum profit. [10]