



MARCH 2016

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) Use a simple example to demonstrate the meaning of **spurious correlation**. [5]
 - b) The personnel department of a large marketing organisation holds regular interview days where potential candidates are required to undergo an interview and a numeracy test. The results for one particular session are shown in the following table:

Candidate	A	B	C	D	E	F	G	H
Interview rank	5	1	3	2	6	8	7	4
Numeracy test score	70	85	80	75	60	60	58	83

Calculate the Rank Correlation Coefficient, and use this to comment on the level of agreement between the interview and testing process. [15]

2. A large builders' merchant has estimated that the number of days between sending out a monthly invoice and receiving the payment from its customers is normally distributed with a mean of 16 days and a standard deviation of 4 days.
 - a) Find the probability that an invoice will not be paid until after 18 days. [5]
 - b) From 200 invoices, how many would be expected to be paid between 12 days and 22 days? [8]
 - c) As an incentive to pay early, the company offers to reward the quickest 10% of customers with a 5% discount on their bills. On what day should the incentive be set? [7]
3. The customer helpline of an insurance company operates from Monday to Friday. As part of a quality assurance exercise, the company monitors the calls to the helpline over a period of three weeks, and the following table shows the results of this exercise:

Week	1					2					3				
Day	M	Tu	W	Th	F	M	Tu	W	Th	F	M	Tu	W	Th	F
No. of enquiries	33	41	77	81	99	39	49	84	90	107	47	55	91	102	113

- a) Plot a graph of the above time series, and comment on any movements that are present. [4]
- b) Using the above graph, decide what will be the most appropriate moving average, and use this to superimpose the trend line on your graph. [8]
- c) Calculate the seasonal component for Monday. [5]
- d) Predict the number of enquiries for the next Monday. [3]

4. a) An index for average wages of the employees of a large supermarket chain over the last five years are given below:

Year	2011	2012	2013	2014	2015
Index	97	99	100	106	114

- i Change the base year to 2013 from 2011, and calculate the new indices for EACH year. [7]
 ii Display the new indices on a graph and make appropriate comments. [5]
- b) The share price of Eatwell Catfood is monitored on a monthly basis, and the following table shows the end of month share price over a three month period in 2014:

Month	Share Price
October	£1.60
November	£1.35
December	£2.50

At the base month of April in 2014, the share price was £1.45 (=100)

Calculate the corresponding simple index numbers for the three months shown. [8]

5. Calum Property Developments has been awarded a contract to refurbish an office block in a town centre. The project has been broken down into a number of activities:

Activity	Immediate preceding activity	Duration (months)
A	-	7
B	-	3
C	A	2
D	A	5
E	B	3
F	C,D	5
G	D	2
H	E,G	4
I	F,H	1

- a) Construct a network diagram for the project. [8]
 b) Determine the project duration and the critical path. [7]
 c) Produce a table showing the total float for all activities. [5]
6. A computer manufacturer produces laptops in two models, A and B. The two models differ only in the type of central processor installed. There are 5,500 of the shell units available each week. Each model A requires 40 minutes of assembly time while a model B requires 30 minutes. There are a total of 3,250 hours of assembly time available each week. Current contractual agreements require that at least 2,000 model A computers must be produced each week. The company makes £100 profit on a model A laptop, and £80 profit on a model B.
- a) Formulate this problem as a linear program with the objective of maximising profits. [10]
 b) Graph the problem and identify the feasible region. [6]
 c) Find the production mix which will maximise total profits, and calculate the maximum profit. [4]

7. The following data shows the weekly value of sales (nearest £) of a particular range of household cleaning products at a small local hardware store during 2015:

363	317	360	599	226
246	197	355	206	298
429	178	561	464	217
553	282	389	508	356
543	307	377	630	396
607	145	338	389	403
137	331	636	337	361
371	351	503	481	663
531	416	685	354	190
269	356	321	490	311

- Using the class intervals £100–£200, £200–£300, £300–£400, etc., produce a cumulative frequency distribution and ogive for the weekly sales. [10]
- From the ogive, estimate the median and quartile deviation of the weekly sales. [5]
- Briefly, explain the meanings of the TWO quantities found in part (b). [3]
- For what proportion of time are the sales expected to exceed £550? [2]

8. The following frequency table shows the monthly production level for a particular model of marine engine, over the last 50 weeks, at R & W Engineers:

Monthly Production	Frequency
30–50	2
50–70	3
70–90	6
90–110	9
110–130	16
130–150	7
150–170	4
170–190	3
Total	50

- Draw a histogram for the above data, and comment on its shape. [5]
- Calculate the mean monthly production level for the engines. [3]
- Calculate the standard deviation for the monthly production level. [8]
- Briefly discuss the statement 'Normally, the mean and standard deviation provide an accurate summary of a set of data'. [4]