General Certificate of Education
January 2006
Advanced Subsidiary Examination

STATISTICS   **SS02**
Unit Statistics 2

Thursday 12 January 2006   1.30 pm to 3.00 pm

Time allowed: 1 hour 30 minutes

Instructions
- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Write the information required on the front of your answer book. The *Examining Body* for this paper is AQA. The *Paper Reference* is SS02.
- Answer **all** questions.
- All necessary working should be shown; otherwise marks for method may be lost.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.
- Fill in the boxes at the top of the insert.

Information
- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.

Advice
- Unless stated otherwise, formulae may be quoted, without proof, from the booklet.

SS02

Answer **all** questions.

1 Rehana wishes to catch a train from her local station to the city centre. There are two local taxi companies: Blue Star and Green Star. In the past Rehana has telephoned both companies. The times, in minutes, that she has had to wait between telephoning and the arrival of a taxi are summarised in the box and whisker plot.
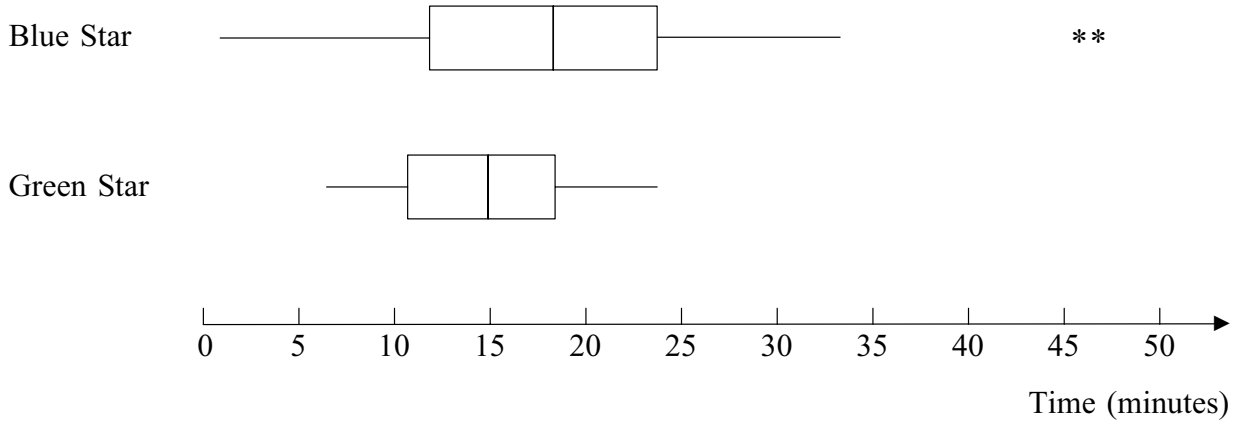
(a) Compare briefly the waiting times for the two taxi companies. *(3 marks)*

(b) Giving a reason for your choice, advise Rehana on which company to telephone if, in order to catch the next train, she needs the taxi to arrive within:

(i) 5 minutes;

(ii) 25 minutes. *(3 marks)*

2 [**Figure 1**, printed on the insert, is provided for use in this question.]

In a small town there is no purpose-built cinema. Edward hires a large hall in the town centre to show films to the general public on Thursday, Friday and Saturday evenings. If a film proves popular, he will continue to show it until he judges demand to be insufficient.

The table shows attendances for the first three weeks of a film which he expected to be popular.

Week	1			2			3		
Day	Thur	Fri	Sat	Thur	Fri	Sat	Thur	Fri	Sat
Attendance	194	360	409	163	340	382	133	292	346

(a) Plot, on **Figure 1**, a graph of the data. *(2 marks)*

(b) Calculate values of a suitable moving average and plot these values on **Figure 1**. *(4 marks)*

(c)   (i) Draw a trend line by eye. *(1 mark)*

   (ii) Use the trend and the 'seasonal' variation to estimate the attendance for Friday of week 4. *(5 marks)*

(d) Edward decides to change the film he is showing when the average attendance falls below 200.

   Forecast the week in which this will occur. Justify your answer. *(2 marks)*

3 A hospital administrator claims that the mean time spent by patients in the Accident and Emergency department is 170 minutes. The times, in minutes, spent in the Accident and Emergency department by a random sample of 9 patients were:

   191   134   218   164   201   196   107   228   294

(a) Test the hospital administrator's claim, using the 5% significance level. Assume that the data come from a normal distribution with standard deviation 45 minutes. *(8 marks)*

(b) Further investigation revealed that the times in the sample were not the times from arriving in the department, but the times from arrivals being recorded by a receptionist. The effect of this is that each of the times in the sample should be increased by 5 minutes.

   How, if at all, does this further information affect your conclusion in part (a)? *(3 marks)*

Turn over ▶

4 Customers enter a large health food shop either alone or in groups.

(a) The number of customers entering alone between 10.00 am and 11.00 am may be modelled by a Poisson distribution with mean 0.7 per minute.

Find the probability that, during a particular minute between 10.00 am and 11.00 am, the number of customers entering the shop alone is:

(i) 3 or fewer;

(ii) exactly 3. *(3 marks)*

(b) The number of groups of customers entering the shop between 10.00 am and 11.00 am may be modelled by a Poisson distribution with mean 0.2 per minute.

(i) Find the probability that, during a particular minute between 10.00 am and 11.00 am, more than one group of customers enters the shop. *(2 marks)*

(ii) Find the probability that 4 or more groups of customers enter the shop between 10.15 am and 10.25 am. *(3 marks)*

(c) State whether the Poisson distribution is likely to provide a suitable model for the **number of customers** entering the shop in groups during each minute between 10.00 am and 11.00 am. Explain your answer. *(2 marks)*

(d) The shop is open from 8.00 am until 6.00 pm. State whether the Poisson distribution is likely to provide a suitable model for the number of customers entering the shop alone during each minute when the shop is open. Explain your answer. *(2 marks)*

5 Members of a library are restricted to a maximum of four books out on loan at any one time. The library committee is considering allowing members to have an unlimited number of books out on loan at any one time. From past experience, Hazel, the librarian, constructs the following probability distribution of X, the number of books which a member currently has out on loan.

x	$P(X = x)$
0	0.51
1	0.04
2	0.02
3	0.03
4	0.40

(a) (i) Write down the mode of X.

    (ii) Show that the mean of X is 1.77.

    (iii) Find the standard deviation of X.   *(6 marks)*

(b) Explain why, for this set of data, the mode is not a useful measure of average.

                                                                                   (1 mark)

(c) Hazel reports that, on average, members have out on loan many fewer than the maximum of four books currently permitted. She concludes that removing the restriction would have very little effect on the total number of books out on loan.

    (i) Comment on the shape of the probability distribution of X.

    (ii) Hence indicate the effect that this might have on Hazel's conclusion.   *(2 marks)*

Turn over for the next question

6 The table relates to unemployment in the United Kingdom from 1996 to 2003.

Unemployment: number by sex and age group								Thousands
	All aged 16 and over	**16–59/64**	**16–17**	**18–24**	**16–24**	**25–34**	**35–49**	**50–64 (m) 50–59 (w)**
All								
1996	2 344	2 324	165	557	722	641	610	357
1997	2 045	2 021	168	489	657	518	533	318
1998	1 783	1 763	159	437	596	468	435	268
1999	1 759	1 740	169	424	593	425	459	269
2000	1 638	1 621	177	403	580	372	414	261
2001	1 431	1 416	146	375	521	328	382	191
2002	1 542	1 521	163	395	558	349	388	218
2003	1 489	1 472	176	407	583	312	363	211
Men								
1996	1 524	1 512	97	359	456	400	393	270
1997	1 283	1 271	90	304	394	325	331	227
1998	1 076	1 067	85	262	347	278	253	194
1999	1 070	1 062	101	250	351	246	278	195
2000	974	968	96	239	335	216	238	186
2001	847	840	85	221	306	190	212	139
2002	918	908	91	245	336	202	227	144
2003	901	894	100	246	346	188	211	149
Women								
1996	820	812	68	198		241	216	87
1997	762	750	78	184	262	194	202	90
1998	707	696	74	175	249	191	183	74
1999	689	678	68	173	241	179	181	75
2000	663	654	81	164	245	157	176	75
2001	583	576	61	154	215	138	171	51
2002	624	613	72	150	222	148	161	73
2003	588	578	76	161	237	123	152	62

Source: *Annual Abstract of Statistics*, Office for National Statistics (2005)

(a) How many men, aged 25–34, were unemployed in 1996? *(2 marks)*

(b) The number of women, aged 16–24, unemployed in 1996 is missing from the table. Evaluate this missing number. *(2 marks)*

(c) (i) Describe briefly the trend in unemployment over the period 1996 to 2003 for all aged 16 and over. *(2 marks)*

(ii) Identify the age group which does not follow the trend described in part (c)(i). For this age group, describe briefly any trend in unemployment over the period 1996 to 2003. *(2 marks)*

(d) Compare the data for men and women, aged 35–49, unemployed over the period 1996 to 2003. *(3 marks)*

7 The government of a European country wishes to survey the opinions of its headteachers. The country is divided into 14 regions. It is proposed to select two of the regions at random and then to select 40 headteachers at random from each of these two regions. These 80 headteachers would then be asked to agree to a face-to-face interview.

   (a)   (i)   Write down the name given to this method of sampling. *(1 mark)*

          (ii)   Give **one** advantage and **one** disadvantage of this method of sampling. *(2 marks)*

   (b)   It is decided to undertake a pilot study before carrying out the survey. For this pilot study a sample of 20 headteachers will be contacted by telephone. A list of the names of the 1934 headteachers in the country is obtained and the names are numbered from 0000 to 1933. It is proposed to select a number between 0000 and 0033 by a random process and to include the corresponding headteacher and every 100th headteacher thereafter in the sample (ie if the number 0017 is selected, then headteachers numbered 0017, 0117, 0217, ... , 1917 would be included in the sample).

          (i)   Write down the name given to this method of sampling. *(1 mark)*

          (ii)   State, giving a reason, whether every headteacher would be equally likely to be selected. *(2 marks)*

   (c)   One change was made to the method proposed in part (b). The process was to be started by selecting a number between 0000 and 0099, instead of between 0000 and 0033.

       For this changed method:

          (i)   state, giving a reason, whether every headteacher would be equally likely to be selected; *(2 marks)*

          (ii)   explain why the sample obtained would **not** be a random sample; *(2 marks)*

         (iii)   comment on the size of the sample which would be obtained. *(2 marks)*

END OF QUESTIONS

There are no questions printed on this page

Surname			Other Names				
Centre Number					Candidate Number		
Candidate Signature							

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STATISTICS   **SS02**
Unit Statistics 2

Insert

Thursday 12 January 2006   1.30 pm to 3.00 pm

Insert for use in **Question 2**.

Fill in the boxes at the top of this page.

Fasten this insert securely to your answer book.

Turn over for Figure 1

Turn over ▶

Figure 1 (for use in Question 2)