General Certificate of Education
January 2007
Advanced Subsidiary Examination

STATISTICS   **SS02**
Unit Statistics 2

Friday 12 January 2007   9.00 am to 10.30 am

For this paper you must have:
- an 8-page answer book
- the **blue** AQA booklet of formulae and statistical tables
- an insert for use in Question 2 (enclosed)
- two sheets of graph paper for use in Questions 4 and 6.

You may use a graphics calculator.

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.
- Show all necessary working; 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, you may quote formulae, without proof, from the booklet.

SS02

Answer **all** questions.

1 The number of letters received by Vasha on a weekday may be modelled by a Poisson distribution with mean 5.0.

   (a) Find the probability that on a particular weekday Vasha receives:

      (i) 4 or fewer letters;

     (ii) exactly 4 letters;

    (iii) 4 or more letters. *(5 marks)*

   (b) Find the probability that the total number of letters received by Vasha over a period of three weekdays exceeds 12. *(3 marks)*

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

A market is held in Pipton on Tuesdays and Saturdays. At these markets, Simon has a stall which sells pet food, and his takings, in £, over the past eight weeks are shown in the table below and illustrated by **Figure 1**.

Week	1		2		3		4		5		6		7		8	
Day	Tue	Sat	Tue	Sat	Tue	Sat	Tue	Sat	Tue	Sat	Tue	Sat	Tue	Sat	Tue	Sat
Takings	378	804	394	809	366	851	422	843	415	862	599	867	451	642	475	898

   (a)   (i) Using the data for **weeks 1 to 4 only**, calculate values of a suitable moving average.

      (ii) Plot the values of your moving average on **Figure 1**.

     (iii) Draw a trend line by eye. *(6 marks)*

   (b) On one market day, during the past eight weeks, there was torrential rain lasting most of the day. State, giving a reason, the day on which you think this rain occurred. *(2 marks)*

   (c) Malik also has a pet food stall at Pipton market. On one market day, during the past eight weeks, he attended a funeral and so did not open his stall. State, giving a reason, the day on which you think Malik attended this funeral. *(2 marks)*

3 Habib shops at his local store. The store sells four different brands of instant coffee in 100-gram jars but not all are available at all times.

When Habib buys instant coffee, he chooses the *Fairtrade* brand if it is available. If it is not available, his preferences, in order, are *Own Brand*, *Brand A*, *Brand B*.

He spends X pence on a 100-gram jar of coffee. The probability distribution shows the price, x pence, of each brand together with the probability that Habib will buy that brand.

Brand	x	$P(X = x)$
Fairtrade	225	0.56
Own Brand	145	0.32
Brand A	249	0.09
Brand B	253	0.03

(a) Show that the mean value of X is 202.4 . *(2 marks)*

(b) Find the standard deviation of X . *(3 marks)*

(c) State the mean and standard deviation of the amount Habib would spend on a 100-gram jar of instant coffee if all brands were available at all times. *(2 marks)*

(d) Give **one** advantage to the store owner of having all brands available at all times.
(1 mark)

Turn over for the next question

Turn over ▶

4 [A sheet of graph paper is provided for use in this question.]

The table shows the number, y, in millions, of visits overseas by residents of a European country from 1993 to 2003. The number of years after 1992 is denoted by t.

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
t	1	2	3	4	5	6	7	8	9	10	11
y	36.7	43.6	45.3	47.0	46.0	43.9	49.9	55.8	61.8	66.4	71.9

(a) Plot a scatter diagram of y against t. *(3 marks)*

(b) The equation of the regression line of y on t is $y = 33.22 + 3.075t$. Add this line to your scatter diagram. *(2 marks)*

(c) Use the regression equation to predict the number of visits overseas in 2004. *(2 marks)*

(d) By examining your graph, or otherwise, modify the prediction that you made in part (c). Indicate the method that you have used and give your answer to an appropriate number of significant figures. *(3 marks)*

5 Kofi owns a cinema. He wishes to increase attendances and so considers offering customers unlimited amounts of free popcorn and soft drinks. He estimates that the likely increase in attendances would result in his business being more profitable, provided that the mean value of the free items consumed by each customer was less than £1.50.

Before deciding whether to proceed, Kofi offers 60 customers entering the cinema free popcorn and soft drinks. The value of the items consumed by each of these customers has a mean of £1.33 and a standard deviation of £0.45. These customers may be regarded as a random sample of all his current customers.

(a) Examine whether the mean value of free popcorn and soft drinks which would be consumed by his current customers is less than £1.50. Use the 5% significance level.

(8 marks)

(b) Explain, in context, the meaning of a Type I error. *(2 marks)*

(c) Give a reason, apart from the possibility of having made a Type I error, why the conclusion reached in part (a) might not apply if it were widely advertised that all Kofi's customers would be offered free popcorn and soft drinks. *(2 marks)*

Turn over for the next question

6 [A sheet of graph paper is provided for use in this question.]

The table shows data on the number of immigrants arriving in Sweden from 1993 to 2001.

SWEDEN, inflows of foreign population by nationality
Thousands

	1993	1994	1995	1996	1997	1998	1999	2000	2001
Iraq	4.6	3.5	2.3	2.1	3.7	5.4	5.5	6.6	6.5
Finland	2.4	2.8	2.8	2.6	2.8	3.0	3.4	3.6	3.4
Norway	1.5	1.6	1.7	1.5	1.5	1.6	2.0	2.9	3.0
Denmark	1.2	1.8	1.8	1.4	1.0	1.1	1.3	2.0	2.5
Former Yugoslavia	3.3	15.8	2.5	0.8	3.9	1.9	1.2	2.9	2.4
United Kingdom	0.7	0.6	0.8	0.9	0.8	1.0	1.0	1.3	1.4
Iran	1.9	1.5	1.1	0.8	1.7	1.5	1.0	1.1	1.3
United States	0.7	0.8	1.1	1.1	0.9	1.0	1.0	1.1	1.1
Bosnia-Herzegovina	20.7	25.7	4.6	1.2	1.8	1.3	1.0	1.2	1.0
Poland	1.0	1.0	0.9	0.7	0.6	0.6	0.7	0.6	0.8
Turkey	0.8	1.1	1.1	1.1	0.8	0.8	0.8	0.7	0.7
Somalia	–	2.8	0.5	0.4	1.1	0.8	0.4	0.6	0.7
India	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.4	0.4
Chile	0.4	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.4
Greece	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.3	0.3
Other countries	15.2	14.9	14.1	13.8	12.0	14.9	14.4	16.9	18.0
Total	**54.8**	**74.8**	**36.1**	**29.3**	**33.4**	**35.7**	**34.6**	**42.6**	**44.1**
of which: **European Union**	5.8	7.0	7.9	7.9	7.1	8.4	8.8	10.8	11.9

Source: *International Migration Data*, Copyright OECD, 2003

(a) (i) How many Indian immigrants arrived in Sweden during 1997? *(2 marks)*

   (ii) Comment on the number of significant figures and the likely accuracy of your answer to part (a)(i). *(2 marks)*

(b) The total number of immigrants arriving in Sweden was much higher during 1993 and 1994 than during the other years. State, with supporting data, which countries contributed most to each of these relatively high totals. *(2 marks)*

(c) Describe the trend, if any, in:

    (i) the **number** of immigrants arriving in Sweden from **1993 to 2001** who were from the European Union;

    (ii) the **proportion** of immigrants arriving in Sweden from **1995 to 2001** who were from the European Union. *(3 marks)*

(d) A researcher studying population movements wishes to know which of the United Kingdom, Iran or the United States provided the largest number of recent immigrants arriving in Sweden.

    (i) For **each** of these three countries, calculate the total number of immigrants arriving in Sweden during the three years 1999, 2000 and 2001. *(2 marks)*

    (ii) Illustrate your results in part (d)(i) using a line diagram. *(3 marks)*

    (iii) Give a reason why a line diagram may be more useful than a pie chart to the researcher. *(1 mark)*

Turn over for the next question

Turn over ▶

7 A bus company has 950 employees who are divided into four employment categories as follows:

      620 drivers;
      120 mechanics;
      130 clerical staff;
and 80 managers.

For each category, a list of the names of the employees is available.

The company hopes to improve morale among the employees by providing better and healthier meals in its canteen. As a first step, it plans to distribute a questionnaire to a sample of employees on the meals currently provided in the canteen.

(a) Describe how random numbers could be used to select a sample of 95 employees stratified by employment category. *(6 marks)*

(b) Describe how a systematic sample of 95 employees could be selected. *(3 marks)*

(c) Data from a similar questionnaire, used at another company, had been analysed. The results suggested that there was little difference in the opinions on canteen meals between the different employment categories but that there was a difference in the opinions on canteen meals between males and females.

The bus company is to decide whether to use the stratified sample from part (a), a differently stratified sample or the systematic sample from part (b). Make **three** points to be considered before this decision is made. *(3 marks)*

END OF QUESTIONS

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STATISTICS   **SS02**
Unit Statistics 2

**ASSESSMENT and
QUALIFICATIONS
ALLIANCE**

Insert

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

Figure 1 (for use in Question 2)

Simon's Takings at Pipton Market