



Oxford Cambridge and RSA

A Level Further Mathematics A

Y542/01 Statistics

Practice Paper – Set 1

Time allowed: 1 hour 30 minutes

You must have:

- Printed Answer Booklet
- Formulae A Level Further Mathematics A

You may use:

- a scientific or graphical calculator

INSTRUCTIONS

- Use black ink. HB pencil may be used for graphs and diagrams only.
- Complete the boxes provided on the Printed Answer Booklet with your name, centre number and candidate number.
- Answer **all** the questions.
- **Write your answer to each question in the space provided in the Printed Answer Booklet.** If additional space is required, you should use the lined page(s) at the end of the Printed Answer Booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.
- You are permitted to use a scientific or graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.
- The acceleration due to gravity is denoted by $g \text{ m s}^{-2}$. Unless otherwise instructed, when a numerical value is needed, use $g = 9.8$.

INFORMATION

- The total mark for this paper is **75**.
- The marks for each question are shown in brackets [].
- **You are reminded of the need for clear presentation in your answers.**
- The Printed Answer Booklet consists of **12** pages. The Question Paper consists of **4** pages.

Answer **all** the questions.

- 1** The numbers of customers arriving at a ticket desk between 8 a.m. and 9 a.m. on a Monday morning and on a Tuesday morning are denoted by X and Y respectively. It is given that $X \sim \text{Po}(17)$ and $Y \sim \text{Po}(14)$.

(i) Find

(a) $P(X+Y) > 40$, [3]

(b) $\text{Var}(2X-Y)$. [2]

(ii) State a necessary assumption for your calculations in part **(i)** to be valid. [1]

- 2** A continuous random variable X has cumulative distribution function given by

$$F(x) = \begin{cases} 1 - \frac{1}{x^3} & x \geq 1, \\ 0 & \text{otherwise.} \end{cases}$$

Find $E(\sqrt{X})$. [5]

- 3** Adila has a pack of 50 cards.

(i) Each of the 50 cards is numbered with a different integer from 1 to 50. Adila selects 5 cards at random without replacement.

(a) Find the probability that exactly 3 of the 5 cards have numbers which are 10 or less. [3]

(b) Adila arranges the 5 cards in a line in a random order. Find the probability that the 5 cards are arranged in numerically increasing order. [1]

10 of the 50 cards are blue and the rest are green.

(ii) Adila randomly selects three sets of 10 cards each, without replacement. The sets are labelled A , B and C . Given that A contains 3 blue cards and 7 green cards, find the probability that B contains exactly 2 blue cards and C contains exactly 3 blue cards. [5]

- 4 Sheena travels to school by bus. She records the number of minutes, T , that her bus is late on each of 32 days. She believes that on average T is greater than 5, and she carries out a significance test at the 5% level.

(i) State a condition needed for a Wilcoxon test to be valid in this case. [1]

Assume now that this condition is satisfied.

(ii) State an advantage of using a Wilcoxon test rather than a sign test. [1]

(iii) Calculate the critical region for the test, in terms of a variable which should be defined. [7]

- 5 A spinner has 5 edges. Each edge is numbered with a different integer from 1 to 5. When the spinner is spun, it is equally likely to come to rest on any one of the edges. The spinner is spun 100 times. The number of times on which the spinner comes to rest on the edge numbered 5 is denoted by X .

(i) Write down (a) $E(X)$, [1]

(b) $\text{Var}(X)$. [1]

(ii) Use a normal distribution with the same mean and variance as in your answers to part (i) to estimate the smallest value of n such that $P(X \geq n) < 0.02$. [3]

(iii) Use the binomial distribution to find exactly the smallest value of n such that $P(X \geq n) < 0.02$. Show the values of all relevant calculations. [3]

- 6 The captain of a sports team analyses the team's results according to the weather conditions, classified as "sunny" and "not sunny". The frequencies are shown in the following table.

		Results		
		Win	Draw	Lose
Weather	Sunny	12	3	5
	Not sunny	8	12	10

(i) Test at the 5% significance level whether the team's performances are associated with weather conditions. [8]

(ii) (a) Identify the cell that gives the largest contribution to the test statistic. [1]

(b) Interpret your answer to part (ii)(a). [1]

- 7 The function $f(x)$ is defined by

$$f(x) = \begin{cases} \frac{1}{4}x(4-x^2) & 0 \leq x \leq 2, \\ 0 & \text{otherwise.} \end{cases}$$

(i) Show that $f(x)$ satisfies the conditions for a probability density function. [3]

(ii) Find the value of a such that $P(X < a) = \frac{15}{16}$. [6]

- 8 At a wine-tasting competition, two judges give marks out of 100 to 7 wines as follows.

Wine	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>
Judge I	86.3	87.5	87.6	88.8	89.4	89.9	90.5
Judge II	85.3	88.1	82.7	87.7	89.0	89.4	91.5

- (i) A spectator claims that there is a high level of agreement between the rank orders of the marks given by the two judges. Test the spectator's claim at the 1% significance level. [7]
- (ii) A competitor ranks the wines in a random order. The value of Spearman's rank correlation coefficient between the competitor and Judge I is r_s .
- (a) Find the probability that $r_s = 1$. [2]
- (b) Show that r_s cannot take the value $\frac{55}{56}$. [2]

- 9 The values of a set of bivariate data (x_i, y_i) can be summarised by

$$n = 50, \sum x = 1270, \sum y = 5173, \sum x^2 = 42767, \sum y^2 = 701\,301, \sum xy = 173\,161.$$

Ten independent observations of Y are obtained, all corresponding to $x = 20$. It may be assumed that the variance of Y is 1.9, independently of the value of x . Find a 95% confidence interval for the mean \bar{Y} of the 10 observations of Y . [8]

END OF QUESTION PAPER

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