OCR
Oxford Cambridge and RSA

AS Level Mathematics A

H230/01 Pure Mathematics and Statistics

Question Set 2

1 Jo is investigating the popularity of a certain band amongst students at her school. She decides to survey a sample of 100 students.

(i) State an advantage of using a stratified sample rather than a simple random sample. **[1]**

Population is split into subsets ∴ gives better overall view

(ii) Explain whether it would be reasonable for Jo to use her results to draw conclusions about all students in the UK. **[1]**

No as results are likely different in different areas

2 The probability distribution of a random variable X is given in the table.

x	0	2	4	6
$P(X = x)$	$\frac{3}{8}$	$\frac{5}{16}$	$4p$	p

(i) Find the value of p. $\sum P(X=x)=1 \quad \frac{3}{8}+\frac{5}{16}+5p=1 \quad p=\frac{1}{16}$ **[2]**

(ii) Two values of X are chosen at random. Find the probability that the product of these values is 0. **[3]**

Either both are 0 or 1 is. $=\left(\frac{3}{8}\right)^2+2\times\frac{5}{8}\times\frac{3}{8}=\frac{39}{64}$

3 The probability that Janice sees a kingfisher on any particular day is 0.3. She notes the number, X, of days in a week on which she sees a kingfisher.

(i) State one necessary condition for X to have a binomial distribution. **[1]**

probability is constant

Assume now that X has a binomial distribution. $X \sim B(7, 0.3)$

(ii) Find the probability that, in a week, Janice sees a kingfisher on exactly 2 days. **[1]**

$P(X=2)=0.318$

Each week Janice notes the number of days on which she sees a kingfisher.

(iii) Find the probability that Janice sees a kingfisher on exactly 2 days in a week during at least 4 of 6 randomly chosen weeks. **[3]**

$Y \sim B(6, 0.318) \quad P(X \geq 4)=1-P(X \leq 3)=1-0.9143=0.0857$

4 It is known that 20% of plants of a certain type suffer from a fungal disease, when grown under normal conditions. Some plants of this type are grown using a new method. A random sample of 250 of these plants is chosen, and it is found that 36 suffer from the disease. Test, at the 2% significance level, whether there is evidence that the new method reduces the proportion of plants which suffer from the disease. **[7]**

$H_0: p=0.2$ $\quad X \sim B(250, 0.2)$

$H_1: p<0.2$ $\quad P(X \leq 36)$

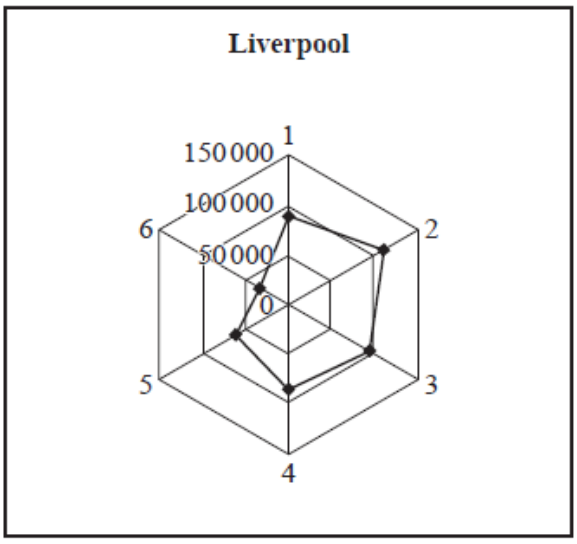
$=0.0139$

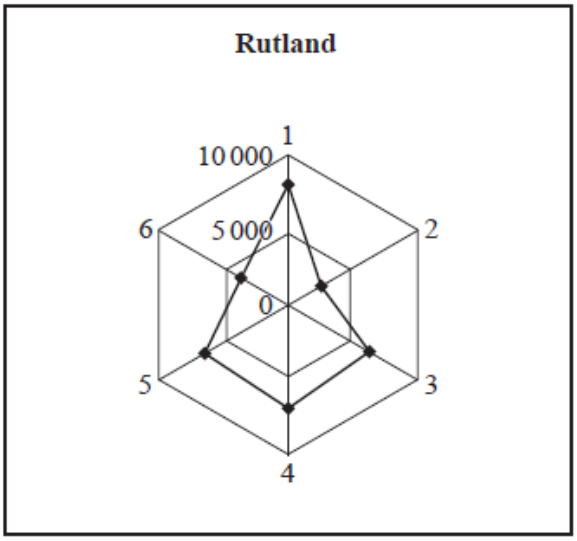
$0.0139 < 0.025$

∴ reject H_0 and accept H_1

as there is evidence to suggest the proportion has decreased

5 The radar diagrams illustrate some population figures from the 2011 census results.





Each radius represents an age group, as follows:

Radius	1	2	3	4	5	6
Age group	0–17	18–29	30–44	45–59	60–74	75+

The distance of each dot from the centre represents the number of people in the relevant age group.

Pro: Diagrams are same size ∴ can be easily compared Con: Makes comparisons harder to make

(i) The scales on the two diagrams are different. State an advantage and a disadvantage of using different scales in order to make comparisons between the ages of people in these two Local Authorities. **[2]**

(ii) Approximately how many people aged 45 to 59 were there in Liverpool? 90,000 **[1]**

(iii) State the main two differences between the age profiles of the two Local Authorities. **[2]**

Liverpool had a greater proportion aged 18-29
Rutland had a greater proportion aged 0-17

(iv) James makes the following claim.

"Assuming that there are no significant movements of population either into or out of the two regions, the 2021 census results are likely to show an increase in the number of children in Liverpool and a decrease in the number of children in Rutland."

Use the radar diagrams to give a justification for this claim. **[2]**

More people of age to have children in Liverpool
Lots of children in Rutland will move up a category and not as many born due to lower child bearing age people

Total Marks for Question Set 2: 26