Examiners' Report

Principal Examiner Feedback

Summer 2019

Pearson Edexcel GCE AS Mathematics

In Further Statistics 1 (8FM0/23)

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Introduction

The candidates were well prepared for this paper which proved to be accessible to almost all. Some of the explanations lacked a little of the detail and rigour required by the new specification but overall the quality of work seen was good.

Comments on individual questions

Question 1

Nearly all the candidates knew the hypotheses were about association or independence and mentioned the context but a surprising number gave H_0 and H_1 the wrong way around. Part (b) was answered very well and the critical value in part (d) was usually quoted correctly with these two marks being scored by the vast majority of the candidates. The explanation in part (c) was not always answered thoroughly enough. We were looking for candidates to realise that some of the rows would need amalgamating because some expected frequencies were less than 5. Some calculated all of the expected frequencies but their calculation in part (b) should have steered them towards the top right-hand cell which had an expected frequency of 3.6 and therefore meant that some amalgamation was required. Those who did identify this value usually realised that amalgamating the first two rows would deal with the small expected frequencies and the ensuing 4x3 table would lead to 6 degrees of freedom. Few candidates calculated the 3.6 (though one mark was available for mentioning the combining or rows leading to the 4x3 table) and some confused rows and columns or just mentioned vaguely combining cells. A common error was to think that amalgamation of cells was required because of the observed frequencies being less than 5 and this sometimes led to combining snooker and bowls or the first and last rows. Others simply thought that the 6 came from a calculation of 8 – 2 presumably confusing with the calculations required for goodness of fit tests. In the final part only a small minority did not know how to use the tables and gave the value 1.635 and those who had their hypotheses the correct way round in part (a) were usually able to give an appropriate conclusion either in terms of there being evidence of association between age and choice of activity or, more simply, stating that there was evidence to support the manager's belief.

Question 2

This question was generally answered very well. Some lost marks for the hypotheses: statements such as the "observed frequencies match the expected frequencies" or "a uniform distribution is a suitable model" were given rather than a comment about the spinner's design such as "the spinner is giving probabilities as it is designed to do". The expected frequencies were usually found correctly but a number of candidates lost marks for incorrectly combining the scores for 1 and 2 because the observed frequency for a score of 2 was less than 5; candidates need to understand that the amalgamation of cells is only required when expected frequencies fall below 5. The calculations and selection of the critical value were usually correct and most realised that the test suggested the spinner was not working as designed.

Question 3

Only few candidates did not realise the significance of the terms "random" and "average rate" and used binomial rather than Poisson models throughout the question but for most candidates this question provided a good source of marks. In part (a) the most frequent error was a mis-interpretation of the phrase “fewer than 2” with many simply finding the probability of less than or equal to 2. Responses to part (b) were often better and most found the new Poisson distribution and used it correctly. Part (c) was the most challenging part of the question with many unable to work out the probability connected with scheme **A**. Most realised there was something to do with a Po(1.7) model but far fewer realising that finding P(X = 0), where X~Po(1.7), was giving them a parameter in a binomial model. Those who realised this often failed to use sufficient accuracy to achieve their final probability correct to 3 significant figures and Y~ B(40, 0.183) was commonly used. The next problem was interpreting “more than 10” correctly and many failed to use 1 – P($Y \leqslant$ 10). There was often more success with the probability associated with scheme **B** and those who had correct probabilities were usually able to correctly recommend scheme **A**. There were many correct answers to part (d) with hypotheses usually given correctly in terms of □ or □ but the common errors were to leave the final answer as P($E \leqslant 3$) rather than $E \leqslant 3$ or confusing a critical region with a critical value and having a final error of E = 3.

Question 4

Parts (a) and (b) were answered very well but a few candidates miscopied their 16r as 6r and proceeded to use this incorrect value in part (c). Most could make a start with part (c) by finding E(X) and hence 6E(X) and E(X^2) + E(6X). Many also managed to find an expression for E(X^3) though sometimes there were sign errors on the negative terms. Finding a second equation in q and r seemed to evade a few but most used the sum of the probabilities to form a second equation and were able to solve their two equations which, if no previous errors had been made, usually led to the correct answers. There were a few blank responses to part (d) and a few who tried comparing expected values and then gave up but a good number made a start on part (d) and quite a few of them, with the help of the final A1 follow through mark, achieved all 4 marks. Some started by rearranging the inequality and factorising the cubic but often they stopped here seemingly unable to draw a simple sketch and solve the cubic inequality. The most common approach though was to form a table with the 10 values for X^3 and X^2 + 6X and by comparing these values to identify X = – 1 and 4 as the required cases and then write down the appropriate probability.

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