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Examiners' Report
Principal Examiner Feedback

January 2019

Pearson Edexcel International Advanced Level
In Statistics S2 (WST02/01)

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January 2019
Publications Code WST02_01_1901_ER

Introduction

This paper proved to be very accessible to all students though questions 1(c), 2(d), 5(iii) and 7(d) were more discriminating.

Question 1

Part (a) proved to be challenging for many students. There were two main errors:

- missing out the context "turning up" in their statement,
- writing one of the necessary requirements for the binomial distribution which is known from the question. A common incorrect answer was to write that there are 2 outcomes.

Most answered part (b) correctly although some students rounded off their answer in (i) to obtain 0.077 rather than give at least 3 significant figures.

Part (c) was not answered well. A minority of students gained the first M1 by finding 880, 940 and 1000 or 60 and 120 but were unable to find the associated probabilities to these values so could not work out the expected total earnings.

Question 2

Part (a) was answered well by the majority of students. The most common errors made were to either use $\mathrm{P}(X \leq 5)$ or give an incorrect answer with no working.

Many candidates identified the correct distribution, Po(6), in part (b). The vast majority then took the approach of finding expressions for $\mathrm{P}(Y = n)$ and $\mathrm{P}(Y = n+1)$ with many able to obtain the correct expressions. However, some candidates were then unable to solve correctly for n. For those candidates that took the tables approach a common incorrect answer was n = 6

In part(c) candidates struggled to write a correct expression for $\mathrm{P}(c \leq D \leq 12)$. The most common error seen was use of $\mathrm{P}(D \leq c)$ rather than $\mathrm{P}(D \leq c-1)$, leading to an answer of

c = 3 rather than c = 4

For those candidates that understood the demand of the question in part (d) full marks were usually awarded. Some candidates used Po(8) or Po(12) for $\mathrm{P}(X = 2)$ and hence did not

obtain an answer of 0.27067... Some candidates, even those that had calculated $P(X = 2)$ correctly did not attempt to use the Binomial at all whilst others just had $(0.2707)^4$. A few candidates failed to include the ${}^6C_4$

Question 3

Part (a) was answered well. Many students wrote down F(7) – F(3) and worked out 0.5

The most common error was to write down F(6) – F(2)

In part (b) the most popular method was to find the full cdf. A minority of students thought this was their pdf and missed the fact that *a*, *b* and *c* were constants.

In part (c), most candidates made a good attempt at finding the mean and even those who had incorrect values for part (b) scored the first two marks, although it is to be hoped that those ending up with a mean of 30 had a little concern about the size of their answer. There were a few candidates who decided to adopt a discrete approach and added a few values together to reach an answer. Very few candidates chose the alternative approach mainly because they chose not to sketch the pdf.

Question 4

This question was generally well done with fewer mistakes in part (a) than part (b) although there were a number of scripts that were completely blank.

In part (a), the hypotheses were usually correctly stated with only a few candidates forgetting to use *p* and almost all getting the inequality in H_1 correct. Many candidates went on to calculate the correct probability but a common error was to find $1 – P(X \leqslant 11)$ or $P(X = 11)$ Candidates who got a probability of 0.0532 correctly compared it with 0.05 and give a correct conclusion. The contextual statement was usually present and with sufficient clarity and detail to gain the final mark.

Although this should have been very straightforward quite a number of candidates were thrown by the unexpected nature of part (b). The mean was mostly correctly stated as was the variance but quite a number of candidates failed to get the mark for the standard deviation by leaving it in the form $\sigma^2 = 4.55$

The best solutions calculated $7 + 2 \times 2.133$ and compared it with 11 although other correct comparisons were seen. It was not unusual to see candidates attempt to use a Normal distribution and standardise the value of 11 and obtain a probability for it.

Question 5

The majority of candidates managed to set up the required probability equation and show their working to get to the required result in part (a)(i).

In part (a)(ii) There were two groups of students - those who slavishly applied the formulaic approach $P(X > c) = \frac{b-c}{b-a}$ leading, on substituting $b = 4a$, to $\frac{4}{3}$ 4/3 and those who applied the substitution immediately to get $P(X > 0)$ which was obviously 1. It was alarming that so many of the first variety were content to leave their answer as a probability greater than 1. Those that weren't content with that often resorted to an answer of 0.

In part (b)(i) and (ii) most students gained full marks although a small number used "39" as their denominator in (ii).

The common errors in part (b)(iii) were not squaring "21" and subtracting rather than adding their answers even if they had quoted the correct formula at the start.

Question 6

Part (i)(a) was well answered although a significant number gave $np < 10$ or even $np > 10$ as the condition.

The most notable errors made in part (ii)(b) was using or writing Po(750) and/or using

$1 - P(Y \leqslant 6)$

Very few candidates gained either of the marks in (ii)

In part (a) very few candidates referred both list (oe) and to all the employees. The most common error was to refer to the list of all the employees who cycle to work. A minority of candidates gained the mark for part (b). The most common incorrect answer was to give a specific Binomial or Normal distribution.

Nearly all candidates were able to gain marks in part (ii)(c). The distribution N(60, 36) was often written clearly at the start of the solution which was good to see. The majority of candidates then went on to gain the method mark and the B mark for the z value. The most common errors were incorrectly applying a continuity correction and the sign of the z value, 1.5, not being compatible with the standardisation.

In part (ii)(d) many candidates were able to gain the method mark with only a minority subtracting the continuity correction rather than adding it.

Question 7

Part (a) was well answered with many candidates gaining full marks. The candidates were able to integrate the 2 parts of the pdf correctly, although quite a few candidates made sign errors when substituting the corresponding limits into $\frac{cx^2}{2}+3cx$. Only a few candidates failed to realise that both parts of the pdf needed to be used to find the value of *c*.

In part (b)(i) many candidates were able to sketch the correct pdf. However, there were quite a few symmetrical sketches and sometimes the RHS was drawn above the LHS at the *y*-axis. Some sketches used curves rather than straight lines. The labels –3 and 3 were usually seen on the *x*-axis, although both of $\frac{1}{4}$ and $\frac{5}{12}$ were not always given on the *y*-axis.

In general candidates were able to explain why the mode was at $X = 0$ in part (b)(ii).

It was pleasing to see many fully correct cumulative distribution functions. The most common error was just integrating $\frac{1}{12}(t+3)$ and $\frac{5}{36}(3-x)$ without adding constants and hence, without using F(–3) = 0 and F(3) = 1 respectively. For those candidates that used the correct limits the common error was to fail to realise that the when integrating the second line of the pdf they also needed to add F(0). In a few cases one of 0, $x<-3$ and 1, $x>3$ was omitted.

Part (d) proved to be a challenge for many of the candidates. For those candidates that understood the demands of conditional probability many correct solutions were seen. However, some candidates wrote $\mathrm{P}(X>d)\cap\mathrm{P}(X>0)$ not realising that this is simply $\mathrm{P}(X>d)$

The most common errors were $\frac{3}{8}$ instead of $\frac{5}{8}$ for 1 – F(0) and after an incorrect equation had been obtained (but the first M1 awarded) the majority of candidates did not show how their answer was obtained as there was usually no explicit substitution into the quadratic formula or equivalent. Some candidates used the wrong line from their CDF. Others found F(d) (or equivalent) correctly but did not proceed any further.

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