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# Examiners' Report

# January 2010

GCE

## Statistics S1 (6683)

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# Statistics Unit S1
# Specification 6683

## Introduction

This proved to be a very accessible paper and most candidates made good progress on Q2, Q3(a), Q4, Q6 and Q7(a).

The general standard of entry appeared to be slightly stronger than in the past and there were fewer candidates making lots of elementary errors.

The calculation of standard deviation and use of linear interpolation (Q3(c) and Q3(d)) along with the normal distribution (Q7(b), Q7(c) and Q7(d)) still proved to be challenging topics.

## Report on individual questions

### Question 1

This proved a straightforward start to the paper. Most gave a correct tree diagram although a few oversimplified using red and not red as their outcomes and this was of no help to them in part (b). It was encouraging to see the vast majority of candidates using fractions for the probabilities and only a handful using "with replacement".

Part (b) was not answered so well with many failing to consider both cases: blue then green and green followed by blue.

### Question 2

Parts (a) and (b) were answered very well although a few candidates gave the upper quartile as 39 or 39.5 (usually as a result of incorrectly rounding $\frac{3n}{4}$) however the follow through marks meant that no further penalty need occur. A few found the upper and lower quartiles but failed to give the interquartile range. Most found the limit for an outlier using the given definition, although a few used $1.5 \times \text{IQR}$, and went on to make a suitable comment about the one employee who needed retraining. There were some excellent box plots seen with all the correct features clearly present but a number failed to plot the outlier appropriately and simply drew their lower whisker to 7. A not insignificant minority were confused by the absence of an upper whisker and felt the need to add one usually at $Q_3 + \text{IQR}$.

## Question 3

Part (a) gave most candidates two easy marks but the rest of the question proved more demanding. The calculation of the mean in part (b) was usually answered well but there were still some dividing by 8 and a few using $\frac{\sum fx^2}{\sum fx}$. The calculation of the standard deviation was better than on previous occasions with many reaching 0.421 but there is still some confusion over the formula with $\sqrt{\left(15889.5-\overline{x}^2\right)}$, a hybrid of the correct formula and $S_{xx}$, being quite common. Candidates should be aware that the formula for standard deviation is very sensitive to rounding errors and an accurate value for the mean (stored on their calculator) should be used rather than a rounded answer. A number of candidates failed to use the given values for $\sum fx$ and $\sum fx^2$ and lost marks because of numerical slips. The attempts at interpolation in part (d) were much improved with the correct fraction often being added to a lower class boundary. Unfortunately many used 2.95 or 2.5 as their class boundary and lost the marks. In part (e) the better candidates used their values for the mean and median and made an appropriate comment. Some spent the next page calculating $Q_1$ and $Q_3$, often correctly, in order to use the quartiles to justify their description of the skewness.

## Question 4

There were many good answers to this question. The Venn diagram was often totally correct although a number failed to subtract for the intersections and obtained value of 35, 40 and 28 instead of 31, 36 and 24 for the numbers taking two options. Parts (b) and (c) were answered very well with only a minority of candidates failing to give probabilities. Part (d) proved straightforward for those who knew what was required but some attempted complicated calculations, often involving a product of probabilities, whilst others simply gave their answer as 4/180.

## Question 5

Despite the compact nature of the probability function many candidates gave clear and fully correct solutions to this question. Part (a) was a "Show that" and candidates needed to make sure that they clearly used $\sum \mathrm{p}(x)=1$ to form a suitable equation in *k*. Part (b) was often answered poorly as a number could not interpret P($X \geq 2$) correctly and gave the answer of $\frac{5}{14}$ (from P($X \leq 2$)). Most could answer part (c) and many part (d) too but the usual errors arose here. Some forgot to subtract $\left(\mathrm{E}(X)\right)^2$ and there were a number of incorrect formulae for Var($1-X$) seen such as: $-\mathrm{Var}(X)$, $1-\mathrm{Var}(X)$, $\left[\mathrm{Var}(X)\right]^2$ and $(-1)^2\,\mathrm{E}(X)$.

## Question 6

This was a high scoring question for most candidates. The calculations in parts (a) and (b) were answered very well with very few failing to use the formulae correctly. Part (c) received a good number of correct responses but many still failed to interpret their value and simply described the correlation as strongly positive. The scatter diagram was usually plotted correctly and most knew how to calculate the equation of the regression line although some used $S_{pp}$ instead of $S_{tt}$ and some gave their final equation in terms of y and $x$ instead of $p$ and $t$. Plotting the line in part (f) proved quite challenging for many candidates and a number with the correct equation did not have the gradient correct. Part (g) was usually well done but some chose to use their graph rather than their equation of the line and lost the final accuracy mark.

## Question 7

Part (a) was usually answered well but the remaining parts of the question proved challenging for many. There was much muddled work in part (b) and although some scored M1B1 for attempts such as $\frac{154-\mu}{\sigma}=1.6449$ very few scored the A1cso for a completely correct derivation without any incorrect statements being seen. Those who fumbled their way to the printed answer in (b) usually came unstuck in part (c). A common error was to write $\frac{172-\mu}{\sigma}=0.5244$ and then replace the 0.5244 with 1-0.5244. Those with a correct pair of equations were usually able to solve them correctly to find $\mu$ and $\sigma$. Many attempted to standardise in part (d) but even those with correct answers in (c) often failed to score full marks either due to premature rounding or because they thought their final answer was 1 - 0.8212. Curiously even a correct diagram failed to prevent some of them from making this final error.

# Grade Boundaries

The table below gives the lowest raw marks for the award of the stated uniform marks (UMS).

| Module | 80 | 70 | 60 | 50 | 40 |
|---|---|---|---|---|---|
| 6663 Core Mathematics C1 | 63 | 54 | 46 | 38 | 30 |
| 6664 Core Mathematics C2 | 54 | 47 | 40 | 33 | 27 |
| 6665 Core Mathematics C3 | 59 | 52 | 45 | 39 | 33 |
| 6666 Core Mathematics C4 | 61 | 53 | 46 | 39 | 32 |
| 6667 Further Pure Mathematics FP1 | 64 | 56 | 49 | 42 | 35 |
| 6674 Further Pure Mathematics FP1 (legacy) | 62 | 54 | 46 | 39 | 32 |
| 6675 Further Pure Mathematics FP2 (legacy) | 52 | 46 | 40 | 35 | 30 |
| 6676 Further Pure Mathematics FP3 (legacy) | 59 | 52 | 45 | 38 | 32 |
| 6677 Mechanics M1 | 61 | 53 | 45 | 38 | 31 |
| 6678 Mechanics M2 | 53 | 46 | 39 | 33 | 27 |
| 6679 Mechanics M3 | 57 | 51 | 45 | 40 | 35 |
| 6683 Statistics S1 | 65 | 58 | 51 | 45 | 39 |
| 6684 Statistics S2 | 65 | 57 | 50 | 43 | 36 |
| 6689 Decision Maths D1 | 67 | 61 | 55 | 49 | 44 |

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