Level 3 Certificate in Business Statistics

International Qualifications from EDI

Annual Qualification Review

2010

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INTRODUCTION

The annual qualification review provides qualification–specific support and guidance to centres. This information is designed to help teachers preparing to teach the subject and to help candidates preparing to take the examination.

The reviews are published in September and take into account candidate performance, demonstrated in both on demand and series examinations, over the preceding 12 months. Global pass rates are published so you can measure the performance of your centre against these.

The review identifies candidate strengths and weaknesses by syllabus topic area and provides examples of good and poorer candidate responses. It should therefore be read in conjunction with details of the structure and learning objectives contained within the syllabus for this qualification found on the website.

The review also identifies any actual or proposed changes to the syllabus or question types together with their implications.

PASS RATE STATISTICS

The following statistics are based on the performance of candidates who took this qualification between 1 October 2009 and 30 September 2010.

Global pass rate 68.01%

Grade distributions

Pass	25.60%
Credit	39.44%
Distinction	34.96%

GENERAL STRENGTHS AND WEAKNESSES

Strengths

- Answers supported by clear workings
- Structured layout to answers

Weaknesses

- Parts of questions omitted
- Errors in copying data from questions
- Wrong method chosen to answer the question, for example, two sample mean test used instead of a paired sample mean test or multiplicative method used in the calculation of the seasonal rather than the additive method.

TEACHING POINTS BY SYLLABUS TOPIC

Syllabus Topic Area 1: Quantitative Information

This topic area usually forms a sub-part of a series of questions.

Specific recommendations to candidates are:

- All graphs need a title, clearly labelled axes and a sensible scale
- Make sure you answer the question asked rather than the one to which an answer is known.

Syllabus Topic Area 2: Descriptive Statistics

The calculation of measures of location and dispersion are the basis for further calculations often relating to Syllabus Area 5 - Statistical Inference. Miscalculations in the answers to means etc can lead to the cumulative loss of marks which significantly reduces the overall marks for the question.

Teaching Points

- The mid-point of grouped data need to be correctly calculated
- Candidates need to be able to identify accurately which data is the variable (x) and which the frequencies (f)
- Candidates who find the standard deviation using either or are more likely to calculate the correct answer.

When asked to compare descriptive statistics candidates must do more than repeat the values given. They need to identify the type of measure being compared e.g. the mean a measure of central tendency or the standard deviation a measure of variation or spread is greater in A than B.

Syllabus Topic Area 3: Forecasting

Responses to this part of the syllabus are some of the best.

Teaching Points

- Care should be taken to distinguish between the dependent and independent variable. The order in which the data is present is not necessarily indicative of the nature of the data.
- Interpretation of the results for the coefficient of determination and its significance for the use of the regression equation can be required.
- Students should be careful to identify the scale of the values used in their regression equation and the scale of the number used when making a prediction.

Syllabus Topic Area 4: Uncertainty

Answers concerning the Normal Distribution are in the main correct.

Some candidates do not know how to calculate the mean and standard deviation for joint normal distributions.

Teaching Points

- Students should be able to calculate the mean and standard deviation for joint normal distributions.

Syllabus Topic Area 5: Statistical Inference

This forms the core of the level 3 syllabus and a number of whole questions or part questions are set on this area in each examination. Many candidates provide correct answers to these questions. However, the opening comment referring to missing answers which omit part of the question, for example: Series 3 2010 Q 3 a) When would you use a paired t test instead of an independent two sample mean test.

Teaching Points

- Candidates must be able to distinguish between a paired comparison test and a two means t test and apply the appropriate test
- Candidates should be able to identify the correct form of the alternative hypothesis and the appropriate critical value of z or t
- Care should be taken when looking up the critical t or chi-squared value that the correct tables are used.

Students should note that either the standard deviation should be calculated using **(n-1)** as the divisor and the t statistic using **n** as the divisor or the standard deviation should be calculated using **n** as the divisor and the t statistic using **(n-1)** as the divisor.

EXAMPLES OF CANDIDATE RESPONSES

A local authority conducts a random sample of the number of planning applications examined per day by its planning officers over a period of five years. The data are shown below.

Number of planning applications examined	Number of days
40 and under 80	103
80 and under 120	68
120 and under 160	38
160 and under 200	22
200 and under 300	15

(a) Calculate the mean and standard deviation for the number of planning applications examined per day.

(9 marks)

(b) Calculate a 95% confidence interval estimate for the mean daily number of planning applications examined.

(5 marks)

The government has set a standard of 120 planning applications to be examined per day.

(c) Test whether the local authority reaches the government standard.

(6 marks)

(Total 20 marks)

Answer

(a)

Number of planning application examined	Number of days
40 and under 80	103
80 and under 120	68
120 and under 160	38
160 and under 200	22
200 and under 300	15
	246

x	*fx*	*fx²*	$f(x-\bar{x})^2$
59.5	6128.5	364645.8	215114.5
99.5	6766.0	673217.0	2209.3
139.5	5301.0	739489.5	44706.6
179.5	3949.0	708845.5	121450.8
249.5	3742.5	933753.8	312337.4
	25887.0	3419951.6	695818.6
	Σfx	$\sum x^2$	$\Sigma f(x-\bar{x})^2$

Arithmetic mean = $\bar{x} = \frac{\Sigma f}{\sum f}$

= $\frac{25887}{246}$ = 105.2 applications per day

Standard deviation = $s = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$

$s = \sqrt{\frac{3419951.6}{246} - \left(\frac{25887}{246}\right)^2}$ = $\sqrt{13902.2 - 1073.7}$ = $\sqrt{2828.5}$

or

$\sqrt{\frac{\sum (x-\bar{x})^2}{\sum f}} = \sqrt{\frac{695818.6}{246}}$

= 53.18 applications per day

(b) 95% confidence interval z = ±1.96

$ci = \bar{x} \pm .96\frac{\sigma}{\sqrt{n}} = 105.2 \pm .96\frac{53.18}{\sqrt{246}}$

= 105.2 ± 6.65= 98.58 to 111.88

(c) Null Hypothesis: The local authority reaches the government standard.
Alternative hypothesis: The local authority does not reach the government standard.

One tail test z = 1.64

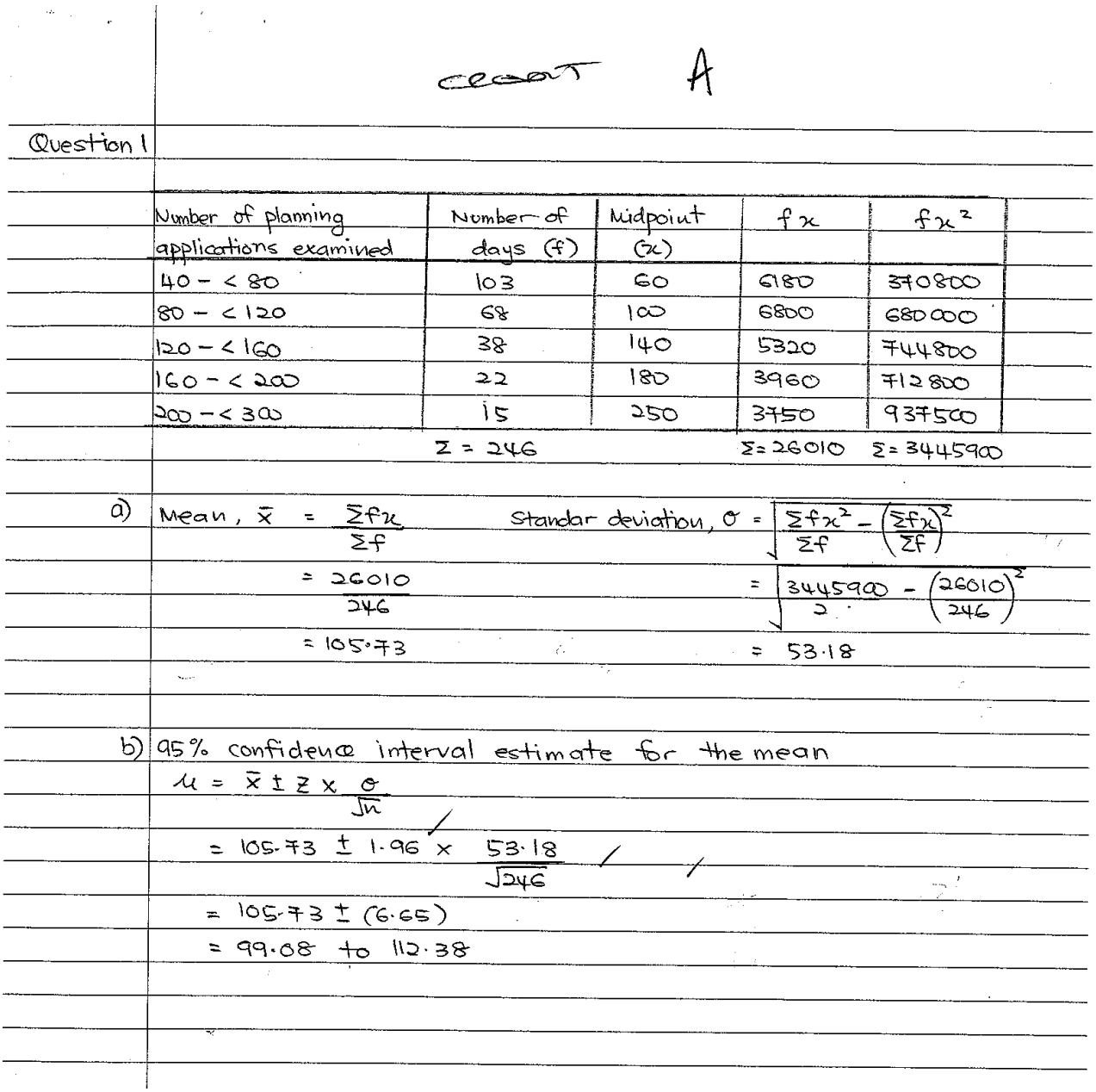
$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{(05.2 - 20)}{\frac{53.18}{\sqrt{246}}}$$

$$= -\frac{14.27}{3.39} = -4.21$$

Conclusion: There is evidence to reject the null hypothesis; the local authority has not reached the government standard.

Script A 19 marks

Is an excellent scripts with all parts of the answer correct The candidate successfully completes all parts of the question. One error occurs the mid points of the class intervals should be 59.5, 99.5 etc.



Question 1

Number of planning applications examined	Number of days (f)	Midpoint (x)	fx	fx^2
40 – < 80	103	60	6180	370800
80 – < 120	68	100	6800	680000
120 – < 160	38	140	5320	744800
160 – < 200	22	180	3960	712800
200 – < 300	15	250	3750	937500
	$\Sigma = 246$		$\Sigma = 26010$	$\Sigma = 3445900$

a) Mean, $\bar{x} = \frac{\Sigma fx}{\Sigma f}$

$= \frac{26010}{246}$

$= 105.73$

Standar deviation, $\sigma = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$

$= \sqrt{\frac{3445900}{2} - \left(\frac{26010}{246}\right)^2}$

$= 53.18$

b) 95% confidence interval estimate for the mean

$\mu = \bar{x} \pm z \times \frac{\sigma}{\sqrt{n}}$

$= 105.73 \pm 1.96 \times \frac{53.18}{\sqrt{246}}$

$= 105.73 \pm (6.65)$

$= 99.08$ to 112.38

Script B 13 marks

Part a is correct apart from the mid points
Part b the candidate wrongly assumes it is a 't' distribution and bases the answer on that assumption. Some marks were awarded for knowing the general approach to confidence interval calculation.
Part c The null hypothesis is correct but the alternative hypothesis is wrong. Again the candidate bases the answer on the't' distribution rather than a normal distribution.

Q1

Let x: number of planning application examined.

Number of planning application	f No of day	x	fx	fx^2
40 – < 80	103	60	6180	370800
80 – < 120	68	100	6800	680000
120 – < 160	38	140	5320	744800
160 – < 200	22	180	3960	712800
200 – < 300	15	250	3750	937500
	246	730	26010	3445900

a) mean: $\bar{x} = \frac{\Sigma fx}{\Sigma f}$

$= \frac{26010}{246}$

$= 105.7317$

Standard deviation: $\sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$

$= \sqrt{\frac{3445900}{246} - \left(\frac{26010}{246}\right)^2}$

$= 53.1839$ 9

b) At 95% confidence interval

$\mu = \bar{x} \pm Z \frac{s}{\sqrt{n}}$

$= 105.7317 \pm 1.96 \frac{53.1839}{}$

$\mu = \bar{x} \pm t \frac{s}{\sqrt{n-1}}$ 11

$= 105.7317 \pm 2.78 \frac{53.1839}{\sqrt{5-1}}$

$= 31.8061$ to 179.6573 $\approx$ 31.81 to 179.66

Script C 5 marks

Part a The calculation for the arithmetic mean is correct. The candidate assumes, wrongly, that $\sum fx^2 = (\sum fx)^2$ for the calculation of the standard deviation.
Part b The wrong formula is identified for the confidence interval, being a cross between the CI for the mean and a proportion. NO marks were awarded
Part c Was not attempted

Question 1

Number of planning applications examined	Number of days (f)	x	fx
40 - < 80	103	60	6180
80 - < 120	68	100	6800
120 - < 160	38	140	5320
160 - < 200	22	180	3960
200 - < 300	15	250	3750
	$\Sigma f = 246$		$\Sigma fx = 26010$

a. mean, $\bar{x} = \frac{\Sigma fx}{\Sigma f}$

$= \frac{26010}{246}$

$= 105.73$

standard deviation, $s = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$

$= \sqrt{\frac{6765201000}{246} - \left(\frac{26010}{246}\right)^2}$

$= \sqrt{27500821.7 - 11179.3}$

$= \sqrt{2738902.5}$

$= 1655.$

b. 95% confidence interval

$\bar{x} = 105.73$

$\sigma = 1655$

$\mu = p \pm \bar{x}\left(\frac{p - (p-n)}{\sigma/\sqrt{n}}\right)$

$= 1.96 \pm 105.73\left(\frac{1.96 - (1.96 - 4)}{1655/\sqrt{246}}\right)$

$= 1.96 \pm 105.73\,(0.038)$

$= 1.96 \pm 4.02$

$= 5.98$ to -2.06

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