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90642

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 3 Statistics and Modelling, 2006

90642 Calculate confidence intervals for population parameters

Credits: Three
2.00 pm Tuesday 21 November 2006

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

Make sure you have a copy of the Formulae and Tables Booklet L3–STATF.

You should answer ALL the questions in this booklet.

Show ALL working.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

For Assessor's use only	**Achievement Criteria**	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Calculate confidence intervals for population parameters. ☐	Demonstrate an understanding of confidence intervals. ☐	Demonstrate an understanding of the theory behind confidence intervals. ☐
Overall Level of Performance ☐		

You are advised to spend 35 minutes answering the questions in this booklet.

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The Bayton Community Council wishes to find enough money to pay for two proposed major projects, namely an Art Gallery and a Sports Complex.

The Council completed a survey of households in Bayton to estimate how much support the Council has for these projects.

A random sample of 500 households in the Bayton community was taken for the survey.

QUESTION ONE

From the 500 households surveyed, 237 said that they would support the building of an Art Gallery. Find a 95% confidence interval for the proportion of all Bayton households that would support the building of an Art Gallery.

QUESTION TWO

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Households supporting the building of an Art Gallery were asked how much they would donate to its building fund.

Of the 237 households supporting this project, the sample mean amount that they would donate was $103.48, and the sample standard deviation was $59.66.

Find a 99% confidence interval for the mean amount that Bayton households supporting this project would donate to a building fund.

QUESTION THREE

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The Council wanted to know if, for households supporting the Art Gallery project, there was a significant difference between the mean amounts that urban and rural households would donate to an Art Gallery Building Fund.

The table summarises the data that was collected:

	Urban	**Rural**
Sample size (number of households surveyed)	147	90
Sample mean (dollars)	108.13	95.89
Sample standard deviation (dollars)	58.66	60.83

Let μ_1 be the mean amount that urban households supporting the Art Gallery project would donate, and let μ_2 be the mean amount that rural households supporting the project would donate.

Find a 90% confidence interval for $\mu_1 - \mu_2$.

QUESTION FOUR

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Of the 500 Bayton households surveyed, 265 (53%) said that they would support the building of a Sports Complex.

This gave a 95% confidence interval for the proportion of all Bayton households supporting the building of a Sports Complex, π_s, as $0.486 < \pi_s < 0.574$.

The Mayor said that the 53% result showed a clear majority of households in Bayton supporting this complex.

Is the Mayor's statement justified? Refer to the above confidence interval when justifying your answer.

QUESTION FIVE

Assessor's use only

Households supporting the building of a Sports Complex were asked how much they would donate to its building fund.

Of the 265 households supporting the project, the sample mean amount that they would donate was \$94.19, and the sample standard deviation was \$47.14.

This gave a 99% confidence interval for the mean amount that Bayton households supporting the Sports Complex project would donate to its building fund, μ_s, as $\$86.73 < \mu_s < \$101.65$ (ie $\$94.19 \pm \$7.46$).

The Mayor suggested that this interval was too wide, and that another survey should be undertaken so that the width of the new interval is one half the width of the previous interval.

What is the minimum sample size required so that the width of the new interval is one-half of the width of that already found?

QUESTION SIX

Assessor's use only

The Council wanted to know if, for households supporting the Sports Complex project, there was a significant difference between the mean amounts that urban and rural households would donate to its Building Fund.

The table summarises the data that was collected:

	Urban	**Rural**
Sample size (number of households surveyed)	148	117
Sample mean (dollars)	92.03	96.92
Sample standard deviation (dollars)	41.35	53.63

Let μ_1 be the mean amount that urban households supporting the Sports Complex project would donate, and μ_2 be the mean amount that rural households supporting the project would donate.

Is there a significant difference between μ_1 and μ_2 with 90% confidence? **Justify** your answer.

QUESTION SEVEN

Assessor's use only

If the Bayton Community Council is to go ahead with the Art Gallery project, it needs estimates of donations to an Art Gallery Building Fund to exceed $400 000.

If the Council is to proceed with the Sports Complex project, it needs estimates of donations to a Sports Complex Building Fund to exceed more than $500 000.

Also, the Council will decide on whether to go ahead with any (or both) of these projects, using calculations of 99% confidence intervals for the total amount that will be donated to each building fund.

The Council finds that, in order to calculate these confidence intervals, it can use estimates of the total number of households supporting the corresponding project as the actual number of supporting households.

The following tables summarise the data that was collected:

Total number of households in the Bayton community	9 500
Number of Bayton households that were surveyed	500

SURVEY RESULTS		
	Art Gallery project	**Sports Complex project**
Number of households supporting the project	237	265
Sample mean for the amount households that support the project are prepared to donate ($)	103.48	94.19
Sample standard deviation for the amount households that support the project are prepared to donate ($)	59.66	47.14

Calculate 99% confidence intervals for the total amount that would be donated to each building fund, and then decide which (if any) of the two projects the Council should go ahead with.

Justify your answer with statistical reasoning.

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Extra paper for continuation of answers if required.
Clearly number the question.

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Question number	