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NZQA
NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

For Supervisor's use only

Level 3 Statistics and Modelling, 2008

90642 Calculate confidence intervals for population parameters

Credits: Three
9.30 am Monday 24 November 2008

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 2–8 in the correct order and that none of these pages is blank.

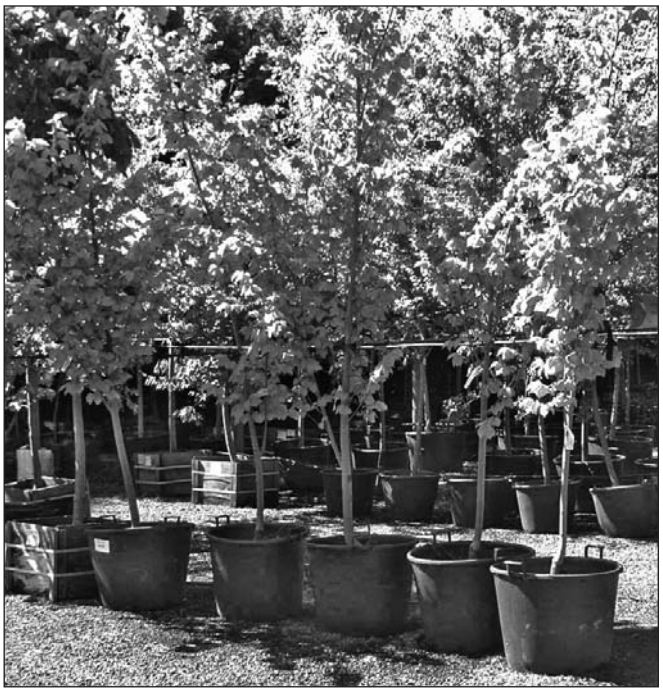
YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

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.

Assessor's use only

THE TREE NURSERY



A tree nursery produces a particular species of tree for garden centres. The manager of the nursery wants to perform an analysis of its stock.

There are currently a large number of these trees in stock. Rather than measuring all these trees, a random sample of **90** trees is taken for analysis.

QUESTION ONE

The height of each tree in the sample is measured. For this sample, the mean height is 142.3 cm and the standard deviation is 13.2 cm.

Find a 95% confidence interval for the mean height of all trees currently in stock.

QUESTION TWO

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(a) In the sample of 90 trees the nursery manager discovers that leaf-spot, a disease caused by a fungus, is present in 10% of them.

Assuming that the leaf-spot fungus occurs randomly in trees, find a 99% confidence interval for the proportion of all trees currently in stock that have leaf-spot.

(b) The manager requires a more accurate indication of the proportion of all trees in stock that have leaf-spot, and decides to take another sample.

She wants to know the proportion of all trees in stock with leaf-spot, estimated to within 4% of the true value with a 99% level of confidence.

Find the minimum sample size that is required to meet this condition.

QUESTION THREE

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The nursery now grows trees in a potting mix that is different from the one used in 2005, when a stock analysis was last completed. The manager believes that this new potting mix has made the trees grow taller.

The table below summarises the data that was collected in 2008 and in 2005. The trees were all of a similar age in both cases.

	2008 stock analysis	**2005 stock analysis**
Sample size (number of trees)	90	75
Sample mean height (cm)	142.3	138.4
Sample standard deviation (cm)	13.2	10.9

Let μ_1 be the mean height of trees in the 2008 stock analysis sample and let μ_2 be the mean height of trees in the 2005 stock analysis sample.

(a) Find a 95% confidence interval for $\mu_1 - \mu_2$.

(b) Explain, in terms of the confidence interval in part (a), whether the manager's belief is justified that the new potting mix has made the trees grow taller.

QUESTION FOUR

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The girth of a tree is the distance around the trunk when measured at a certain height above the ground.

The girth of each of the 90 trees in the sample is also measured and the following 96% confidence interval is obtained for μ, the mean girth of all trees in stock:

$$8.3 \text{ cm} \leq \mu \leq 34.1 \text{ cm}$$

(a) Explain, in terms of the girth of all trees in stock, the meaning of this confidence interval.

(b) If the sample size had been k times greater, but the sample mean, sample standard deviation and confidence level had stayed the same, what would have been the width of the interval obtained?

QUESTION FIVE

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The nursery manager predicts that the mean height of all the trees in stock will be 150 cm.

If this prediction is correct, **calculate** the probability that a random sample of 90 trees from the nursery's stock would produce a mean height of 142.3 cm or less, and **comment** on what that would imply about such a sample.

(Note: use the sample standard deviation of 13.2 cm as an estimate of the population standard deviation.)

QUESTION SIX

The mean weight of the potted trees in the sample is 38.7 kg, with a standard deviation of 2.4 kg.

A trailer is to be loaded with 12 of these trees. Calculate a 95% confidence interval for T, the true total weight of a trailer-load of 12 trees.

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

Assessor's use only

Question number	

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Clearly number the question.

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