VCE Specialist Mathematics   
Units 3 and 4

Sample modelling or problem-solving task – hypothesis testing from a known population

Introduction

This modelling task gives the student the opportunity to see multiple sampling from a population that is normal. Confidence intervals can be constructed and compared and hypothesis tests (two and one-tailed tests) can be undertaken based on different samples, see, for example: [AMSI](http://amsi.org.au/ESA_Senior_Years/SeniorTopic4/4_md/SeniorTopic4i.html)

Assume a population that is known to be normally distributed with mean 100 and standard deviation 10.

Part 1

1. Use simulation to generate 500 samples of size 20 from this population and find the mean of each of these samples.
2. Identify the maximum and minimum of these means.
3. Construct a suitable graph of the distribution of the sample means.
4. Randomly select 20 of the samples and construct 95% confidence intervals for the mean from these samples. Illustrate by line segments indicating the position of the population mean in relation to these confidence intervals.

Part 2

1. Let the null hypothesis be that H0: *μ* = 100 and H1: *μ* ≠ 100. Test at the 5% significance level for several of the samples including the samples that had the minimum and maximum means.
2. Let the null hypothesis be that H0: *μ* = 100 and H1: *μ* < 100. (or H1: *μ* > 100 ) Test at the 5% significance level for 5 of the samples including the samples that had the minimum and maximum means.

An assessment task can be developed from this learning activity by choosing a suitable context for the population. These could include mean weights of contents of packaging, such as potato chips or beans, or the measurement of some component of a production process.

Areas of study

The following content from the areas of study is addressed through this learning activity.

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| **Area of study** | **Content dot point** |
| Data analysis, probability and statistics | 4, 5, 6, 7, 8, 9, 10, 11,12,13 |

Outcomes

The following outcomes, key knowledge and key skills are addressed through this task.

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| **Outcome** | **Key knowledge dot point** | **Key skill dot point** |
| **1** | 13 | 15, 16 |
| **2** | 1, 2, 3, 6 | 1, 2, 4, 6,7 |
| **3** | 1, 2, 3, 6 | 2, 3, 4, 5, 6, 8, 9, 10 |