STATISTICS 3, S3 (4768) A2

Objectives

To introduce students to more advanced statistical ideas, based on the foundation provided by *S1* and *S2*, particularly involving continuous random variables and inference.

Assessment

Examination   (72 marks)
1 hour 30 minutes
There will be four questions each worth about 18 marks.

Assumed Knowledge

Candidates are expected to know the content for *C1*, *C2*, *C3* and *C4* and for *S1* and *S2*.

Calculators

In the MEI Structured Mathematics specification, no calculator is allowed in the examination for *C1*. For all other units, including this one, a graphical calculator is allowed.

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STATISTICS 3, S3		
Specification	**Ref.**	**Competence Statements**

CONTINUOUS RANDOM VARIABLES

Specification	Ref.	Competence Statements
The probability density function (pdf) of a continuous random variable.	S3R1	Be able to use a simple continuous random variable as a model.
	2	Understand the meaning of a pdf and be able to use one to find probabilities.
	3	Know the properties of a pdf.
	4	Find the mean and variance from a given pdf.
	5	Find the mode and median from a given pdf.
The cumulative distribution function (cdf) and its relationship to the probability density function.	6	Understand the meaning of a cdf and know how to obtain one from a given pdf.
	7	Know how to obtain a pdf from a given cdf.
	8	Use a cdf to calculate the median and other percentiles.

EXPECTATION ALGEBRA

Specification	Ref.	Competence Statements
Calculation of probability, expectation (mean) and variance of random variables.	S3a1	Be able to use the result $\mathrm{E}(a + bX) = a + b\mathrm{E}(X)$.
	2	Be able to use the result $\mathrm{Var}(a + bX) = b^2\mathrm{Var}(X)$.
Linear combinations of two (or more) independent random variables.	3	Know how to find the mean and variance of any linear combination of independent random variables.
The distribution of a linear combination of independent Normal variables.	4	Be able to use linear combinations of Normal random variables in solving problems.

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STATISTICS 3, S3		
Specification	**Ref.**	**Competence Statements**

		INFERENCE
Sampling methods.	S3I1	Know the definition of the term simple random sample.
	2	Understand the use of different sampling methods.
Estimation of population mean and variance from a simple random sample.	3	Be able to estimate population mean from sample data.
	4	Be able to estimate population variance using the sample variance, s^2.
Distribution of the mean of a sufficiently large sample.	5	Understand how and when the Central Limit Theorem may be applied to the distribution of sample means.
Standard error of the mean.	6	Be able to calculate and interpret the standard error of the mean.
Symmetric confidence intervals for the mean.	7	Understand the term confidence interval and be able to construct confidence intervals for the mean using Normal or t distributions.
	8	Be able to construct and interpret confidence intervals for the difference in mean of paired populations using the Normal or t distribution.
Hypothesis tests: (a) t test for a single mean;	9	Be able to carry out a hypothesis test for a single mean using the t distribution and know when it is appropriate to do so.
(b) paired t test;	10	Be able to carry out a hypothesis test on the difference of means for paired data using the t distribution and know when it is appropriate to do so.
(c) Wilcoxon signed rank test;	11	Be able to carry out a hypothesis test for a single median using the Wilcoxon signed rank test and know when it is appropriate to do so.
(d) Wilcoxon signed rank test;	12	Be able to carry out a hypothesis test for paired data using the Wilcoxon signed rank test and know when it is appropriate to do so.
(e) χ^2 test for goodness of fit.	13	Be able to carry out a χ^2 test for goodness of fit of a model, understanding and using degrees of freedom.

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