MS455/555 Exam Guide

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General

- The MS555 exam is 2.5 hours in duration with 4 questions to answer from 4.
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- Approved calculators and log tables may be used.
- Chapter 1 of the course notes is *essential background knowledge* for the exam.

Question 1 – Generating and Testing Random Numbers

Chapter 2 of the course notes

Linear Congruential Generators

- Define, state properties, conditions for a full period, simple examples.

Chi–square Test

- Describe the test, carry out the test on different distributions.

Kolmogorov–Smirnov Test

- Describe how to carry out the test, define and compute the empirical c.d.f of a sample.

Practical considerations when using random number generators.

Question 2 – Generating R.V.'s with a given Distribution

Chapter 2 of the course notes

Inverse Transform Method

- Proof of method, calculation questions, outline algorithm.

Acceptance–rejection Method

- Proof of method, calculation questions, outline algorithm, interpret algorithm.

Question 3 – The Monte Carlo Method

Chapter 3 of the course notes

- Estimate integrals as expectations of random variables.
- Properties/theory of the Monte Carlo estimator.
- Confidence intervals for Monte Carlo estimates.

Question 4 – Stochastic Differential Equations

Chapter 4 of the course notes

- Definition and properties of Brownian motion.
- Calculations using Itô's Lemma and properties of the Itô integral.
- Notions of convergence and convergence order – relevance for applications.
- Statements and derivations of the EM and Milstein schemes.
- Conditions for SDEs to have unique solutions, conditions for EM and Milstein schemes to converge (weak or strong and with a given order).