

MTH5118 Probability II

Key objectives

To obtain a pass in the examination, you should be able to do all of the following.

- (a) Understand the probability generating function. Know the probability generating function of Bernoulli, binomial, geometric and Poisson random variables.
 - (a1) Find the probability mass function from the probability generating function.
 - (a2) Find the expected value and variance from the probability generating function.
 - (a3) Find the probability generating function of the sum of two independent random variables.
- (b) Be able to calculate expectations by conditioning.
- (c) Define and recognise branching processes.
 - (c1) Calculate the probability that a branching process becomes extinct by generation n .
 - (c2) Calculate the probability that a branching process become extinct *eventually*.
- (d) Define and recognise Gambler's Ruin problems. For Gambler's Ruin problems, calculate the probability that the random walk will hit one end-point of the interval prior to the other.
- (e) Understand the joint probability density function of two jointly continuous random variables.
- (f) For two jointly continuous random variables X and Y ,
 - (f1) find the expected value of a function of X and Y (such as X^2 or XY);
 - (f2) find the marginal probability density functions of X and Y from the joint probability density function;
 - (f3) check whether the random variables are independent or not.
- (g) Know the main properties of bivariate normal distribution.
- (h) State and use Markov's inequality and Chebyshev's inequality.

Turn over

The examination will contain a number of short questions. The rubric will be as follows.

You should attempt all questions on this paper. Marks awarded are shown next to the questions.

Calculators ARE permitted in this examination, but no programming, graph plotting or algebraic facility may be used. The unauthorised use of material stored in a pre-programmable memory constitutes an examination offence. Please state on your answer book the name and type of machine used.