

MTH6112 Actuarial Financial Engineering
Coursework Week 10

1. A company has just issued zero-coupon bonds with expiration time of 2 years and the total nominal value of £3 million. The total value of the company now stands at £4 million. A continuously compounded interest rate is 5% per annum. The total value of the company follows the Geometric Brownian motion with parameters $\mu = 0.4$ and $\sigma = 0.2$.
 - a) Under the Merton model, find the current value of the shareholders' equity.
 - b) In 1 year time, the company's value drops by 20%. What is the probability of the company's default on its obligation to bondholders.
 - c) (optional, will not appear in the exam) After the value drops, the company decides to issue new bonds with the same maturity date. It is known that this move was the cause of the shareholders' equity drop by 70%. What is the debt of the company to bondholders at the end of the 2 years' period?

Hint We apply Newton's method to get the numerical solution. You may use the formula for $\frac{\partial C}{\partial K}$.