

# Extra Questions

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Note: the questions are adapted from unimelb subject Topics in Insurance and Finance (ACTL90021)

## Question 1

Let  $i_t$  be the rate of return over the peiord  $(t - 1, t)$  and suppose  $\{i_t : t = 1, \dots, 15\}$ . Is a series of independent random variables all distributed  $U(0.06, 0.12)$ . Let  $A_{15}$  reperesent the accumulation, at time 15, of 1 invested at time 0.

- (a) Calculate the mean and standard deviation of  $A_{15}$ .
- (b) Making such theoretical assumptions as you feel might be appropriate, calculate the probability that  $A_{15} > 4$ .
- (c) Simulate and plot  $A_{15}$  and  $\log A_{15}$ , describe the results.

## Question 2

Make the same assumptions in relation to  $\{i_t : t = 1, \dots, 15\}$  as the previous exercise and let  $\ddot{s}_{15}$  represent the accumulation, at time 15, of 1 invested at times 0, 1, ....and 14. Calculate the mean and variance of  $\ddot{s}_{15}$ .

## Question 4

Consider a sequence of n payments of  $1, (1 + s), (1 + s)^2, \dots, (1 + s)^{n-1}$ , at unit intervals with the first payment due immediately where s is a scalar constant.

Let  $i_t$  be a random variable denoting the return over the time period  $(t - 1, t)$  where  $\{i_t : t = 1, \dots, n\}$  is a set of independent and identically distributed random variables.

Calculate the first two moments and variance of:

- (i)  $\ddot{z}_{15}$ , the accumulation of this cash-flow at time 15 and
- (ii)  $\ddot{u}_{15}$ , the present value of this cash-flow.

Assume  $(1 + i_t)$  follows log normal distribution  $\mu = 0.08$  and  $\sigma = 0.04$  and that  $(1 + i_t)^{-1}$  follows log normal distribution  $\mu = -0.08$  and  $\sigma = 0.04$ .