MA 374: FE - Assignment #11

Due on Monday, April 18, 2016

Silvi Pandey (130123045)

PROBLEM

Consider the Vasicek model :

$$dr = \beta(\mu - r)dt + \sigma dW$$

For the three parameter sets $[\beta, \mu, \sigma, r(0)]$ given by $[5.9, 0.2, 0.3, 0.1]$, $[3.9, 0.1, 0.3, 0.2]$ and $[0.1, 0.4, 0.11, 0.1]$, plot the term structure up to 10 time units (i.e, plot yield versus time). Now for each of the three parameter sets, plot yield curves versus maturity up to 500 time units for ten different values of r(0).

SOLUTION

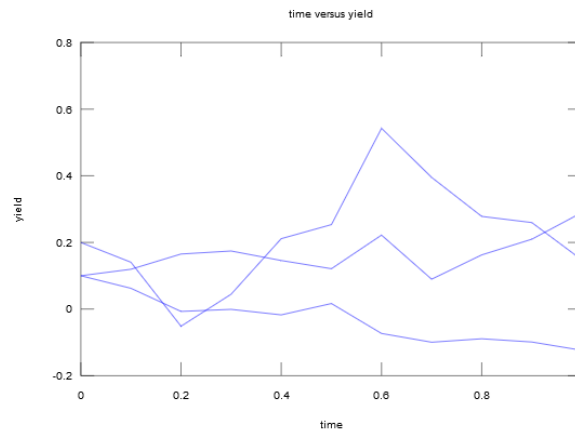Using Monte Carlo Simulation :

$$\Delta r = \beta(\mu - r)\Delta t + \sigma\sqrt{\Delta t}Z$$

where Z is a normal random variate with mean 0 and variance 1. The paths hence were plotted using the following equation :

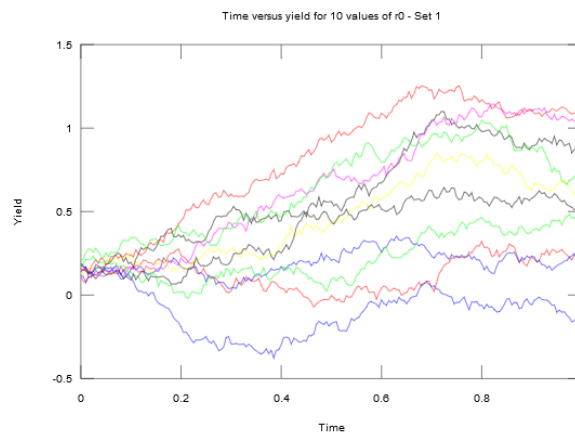$$r(j) = r(j-1) + \beta(\mu - r(j-1))\Delta t + \sigma\sqrt{\Delta t}Z$$
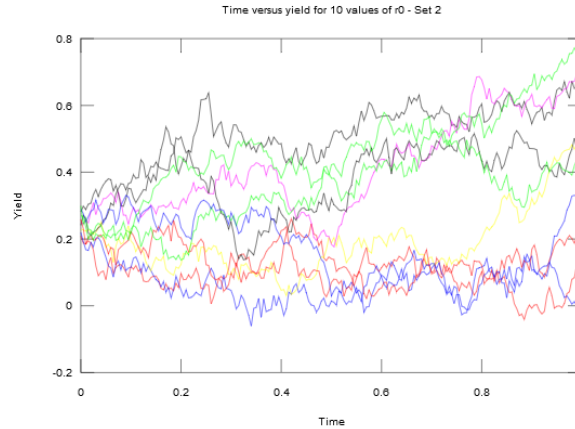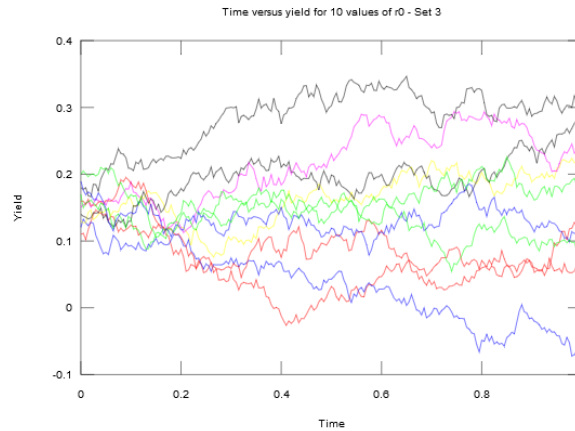
Value of Δt taken was 0.1.

Part 1 (For 10 time units) :

Part 2 (For 500 time units) :
Parameter Set 1 :

Parameter Set 2 :

Parameter Set 3 :

Values of r(0) taken in all the cases are :
$r(0)^{new} = r(0)^{old} + 0.01$ where $r(0)^{old}$ in the first iteration is the value of r(0) given in each set.

PROBLEM

Consider the CIR model :

$$dr = \beta(\mu - r)dt + \sigma\sqrt{r}dW$$

For the three parameter sets $[\beta, \mu, \sigma, r(0)]$ given by $[0.02, 0.7, 0.02, 0.1]$, $[0.7, 0.1, 0.3, 0.2]$ and $[0.06, 0.09, 0.5, 0.02]$, plot the term structure up to 10 time units (i.e, plot yield versus time). For the parameter set $[\beta, \mu, \sigma]$ given by $[0.02, 0.7, 0.02]$ and with $r(0) = 0.1 : 0.1 : 1$, plot yield curves versus maturity for 600 time units.
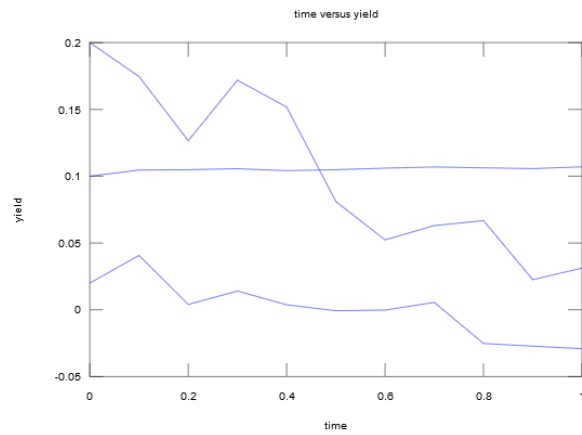
SOLUTION

Using Monte Carlo Simulation :

$$\Delta r = \beta(\mu - r)\Delta t + \sigma\sqrt{r\Delta t}Z$$

where Z is a normal random variate with mean 0 and variance 1. The paths hence were plotted using the following equation :
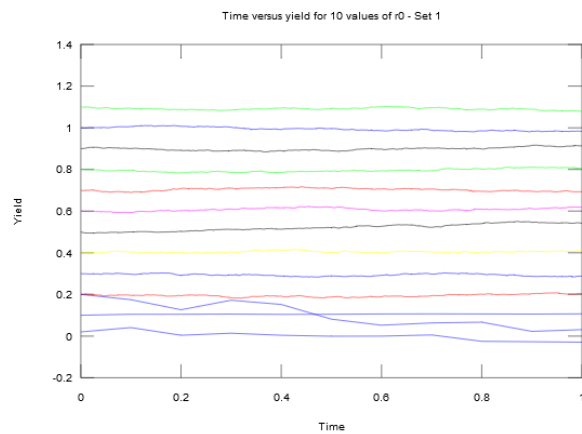
$$r(j) = r(j-1) + \beta(\mu - r(j-1))\Delta t + \sigma\sqrt{r(j-1)\Delta t}Z$$

Value of Δt taken was 0.1

Part 1 (For 10 time units) :

Part 2 (For 600 time units) :

Observations :
1. The rate of interest in the case of Vasicek's Model is more fluctuating compared to CIR model.
2. The rate of interest evolves almost as a constant when r(0) = 0.1