

# Assignment XI

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## **Aim of the Problem:**

The problem discusses ways to simulate Exponential Brownian Motion in time intervals  $[0,5]$ .

## **Part I:**

This question wants us to generate 500 Exponential BM( $\mu,6$ ) using recursive technique.

## **Implementation using R:**

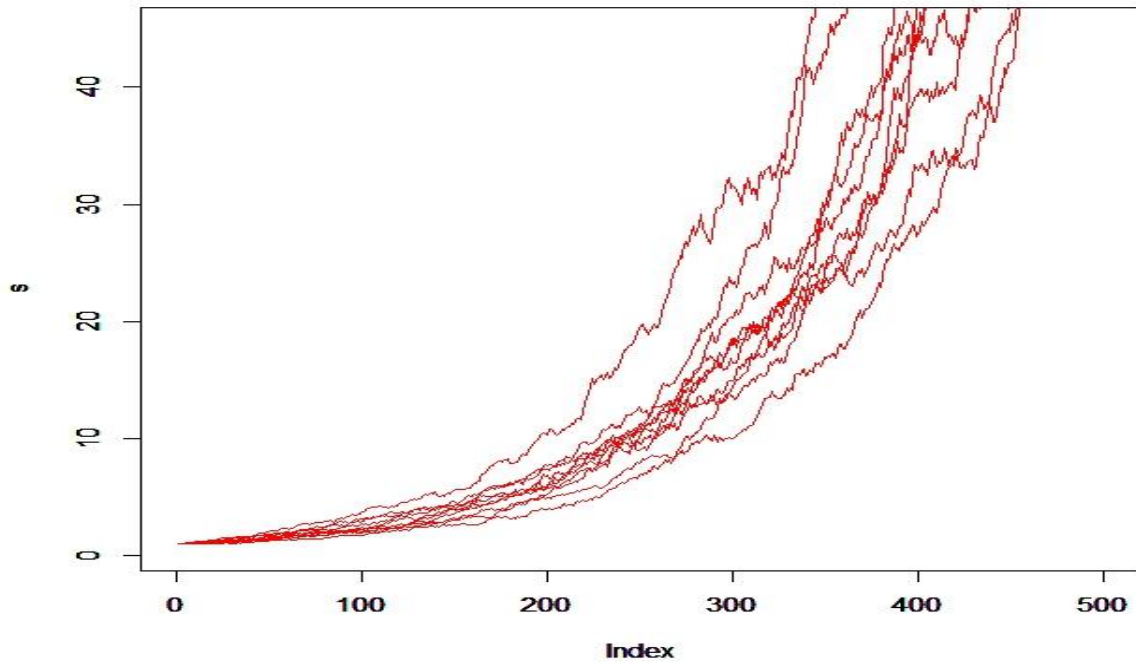
```
for(j in 1:10)
{
  z<-rnorm(500,mean=0,sd=1);
  w<-NULL;wm1<-NULL;wm2<-NULL;
  t<-seq(0,5,length.out=500);
  w[1]=1;
  sig<-0.4;
  mu<-1;
  for(i in 2:500)
  {
    w[i]=w[i-1]*(exp(((mu-(sig*sig/2))*(t[i]-t[i-1]))+(sig*(sqrt(t[i]-t[i-1]))*(z[i])))));
  }
  wm1<-c(wm1,w[2]);
  wm2<-c(wm2,w[5]);
  s<-w;
  plot(s,type="l",col="black",ylim=c(0,110));
  par(new=TRUE);
}
k1<-mean(wm1);
k2<-mean(wm2);
```

## Assignment XI

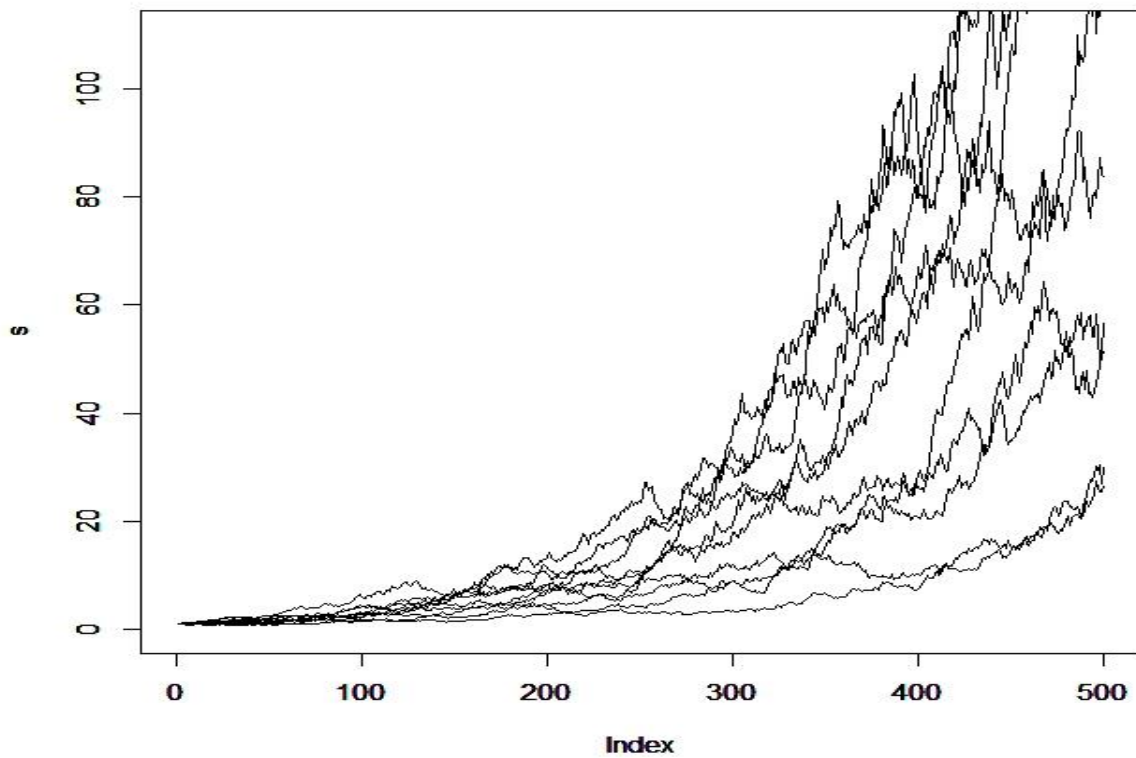
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**The following plots were obtained for 10 paths:**

a) mean=1, variance=0.2



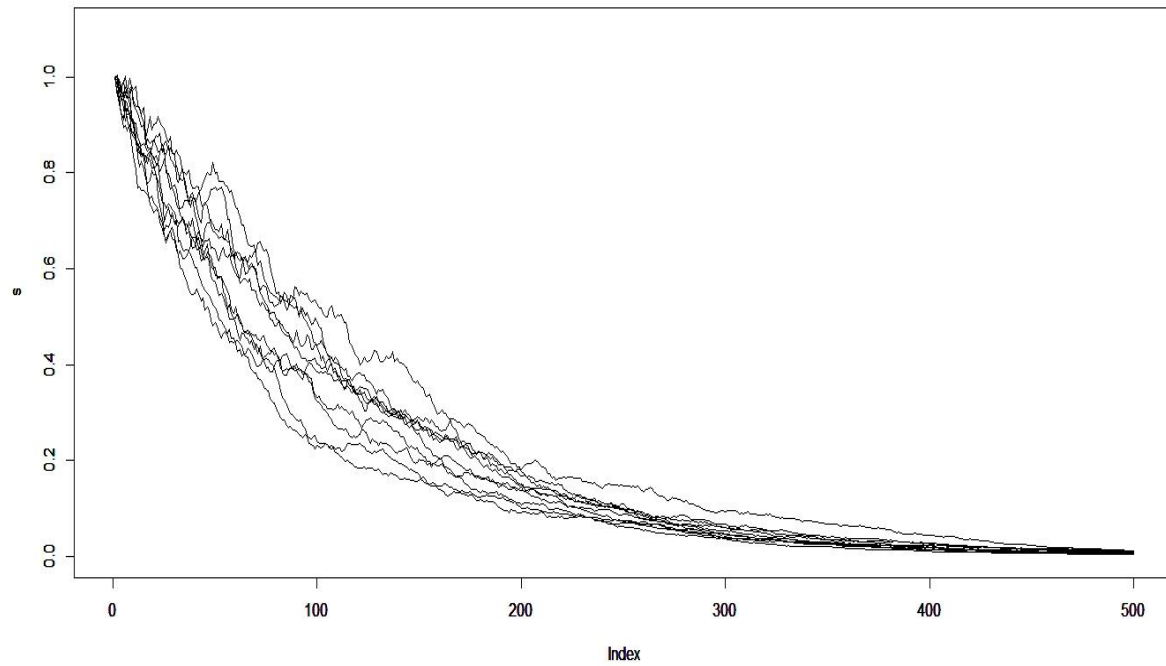
b) mean=1, variance=0.4



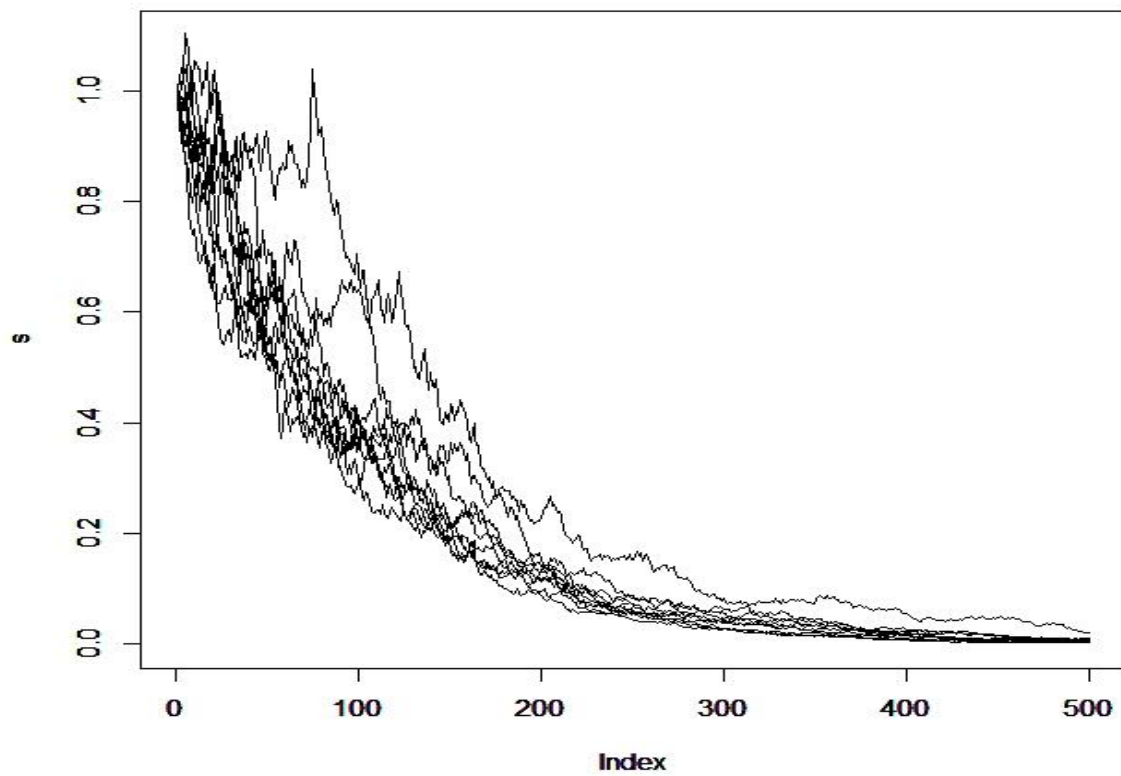
## Assignment XI

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c) mean=-1, variance=0.2



d) mean=-1, variance=0.4



## Assignment XI

**The following table gives the comparison values:**

(this was done for 100 paths)

mean	variance	$E[S(5)]$	$\text{Var}[S(5)]$	$E[S(5)](\text{th.})$	$\text{Var}[S(5)](\text{th.})$
<b>1</b>	0.2	143.6162	4584.175	148.4132	4876.72
<b>1</b>	0.4	133.661	16882.91	148.4132	26994.34
<b>-1</b>	0.2	0.00688	0.000125	0.006737	0.000105
<b>-1</b>	0.4	0.00557	0.000268	0.006737	0.000556

The density plot of  $S(5)$ :

