

Oppgave 4

GARCH

Pakker

```
In[1]:= << Statistics`ContinuousDistributions`  
<< Graphics`Graphics`  
<< Statistics`DataManipulation`
```

Valgte parametre

```
In[4]:= T = 5000;  
zGBM = Table[Random[NormalDistribution[0, 1]], {i, T}];  
zGARCH = Table[Random[NormalDistribution[0, 1]], {i, T}];  
 $\mu$  = 0.0;  
 $\sigma$  = Table[0, {i, T}];  
logAvkastningerGARCH = Table[0, {i, T}];  
 $\theta_0$  = 0.000002;  
 $\theta_1$  = 0.09;  
 $\theta_2$  = 0.89;  
k = 3;
```

Volatilitet

```

In[13]:=  $\sigma[[1]] = k \sqrt{\frac{\theta_0}{1 - (\theta_1 + \theta_2)}};$ 
forventetVolatilitet[t_] :=  $\sqrt{\frac{\theta_0 (1 - (\theta_1 + \theta_2)^t)}{1 - (\theta_1 + \theta_2)} + (\theta_1 + \theta_2)^t \sigma[[1]]^2};$ 
Print["Startvolatiliteten er ",  $\sigma[[1]]$ ,
      " pr dag og den langsiktige forventningen til volatiliteten er ",  $\sqrt{\frac{\theta_0}{1 - (\theta_1 + \theta_2)}}$  ];

```

Startvolatiliteten er 0.03 pr dag og den langsiktige forventningen til volatiliteten er 0.01

log avkastninger

```

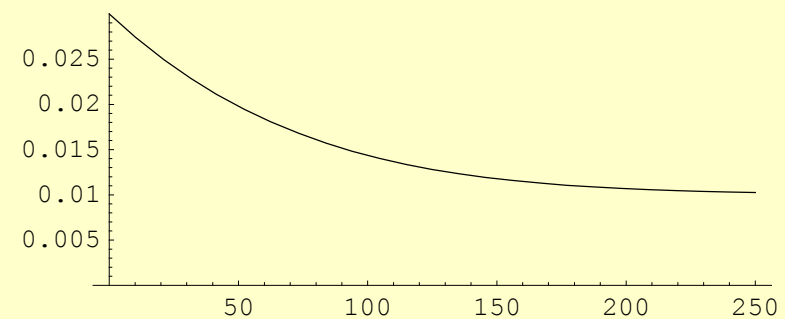
In[16]:= logAvkastninger =  $\mu + \sqrt{\frac{\theta_0}{1 - (\theta_1 + \theta_2)}} z_{GBM}$ ;
logAvkastningerGARCH[1] =  $\mu + z_{GARCH}[1] \sigma[1]$ ;
For[i = 2, i ≤ T,
  ( $\sigma[i] = \sqrt{(\theta_0 + \theta_1 (z_{GARCH}[i - 1] \sigma[i - 1])^2 + \theta_2 \sigma[i - 1]^2)}$ ; logAvkastningerGARCH[i] =  $\mu + z_{GARCH}[i] \sigma[i]$ ); i++];

In[20]:= range = {Min[logAvkastningerGARCH], Max[logAvkastningerGARCH]};

```

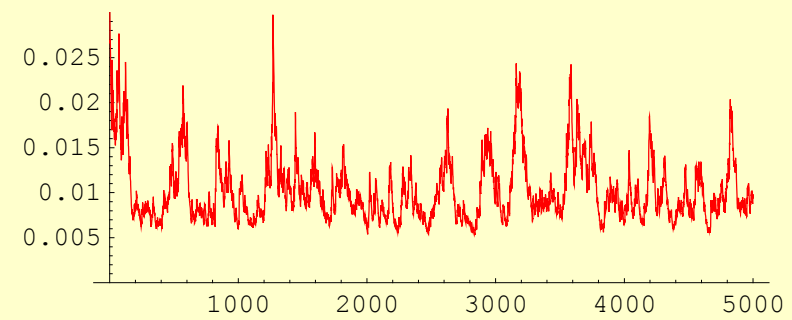
Forventet volatilitet med GARCH(1,1)

In[21]:= `Plot[forventetVolatilitet[t], {t, 0, 250}, PlotRange -> {0, Max[σ]}, AspectRatio -> .4];`



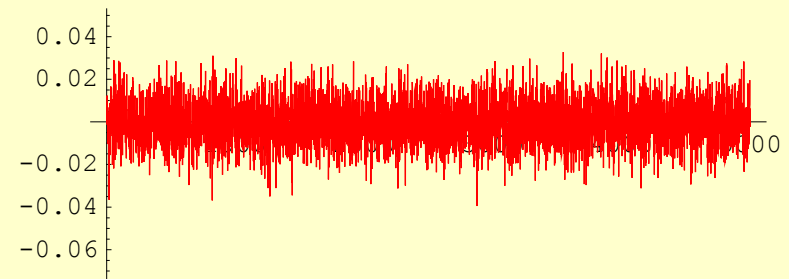
Realisert volatilitet med GARCH(1,1)

```
In[22]:= ListPlot[ $\sigma$ , PlotJoined  $\rightarrow$  True, AxesOrigin  $\rightarrow$  {0, 0},  
PlotRange  $\rightarrow$  {0, Max[ $\sigma$ ]}, PlotStyle  $\rightarrow$  RGBColor[1, 0, 0], AspectRatio  $\rightarrow$  .4];
```



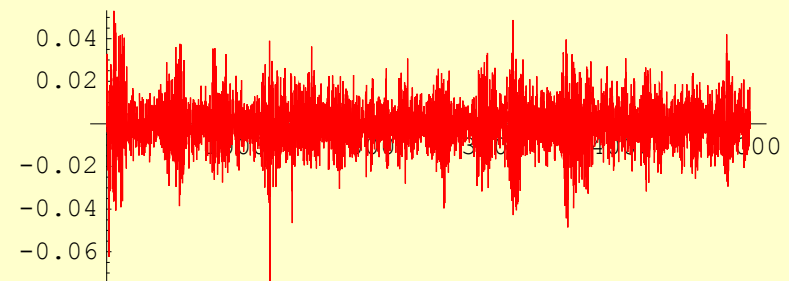
log avkastninger med konstant volatilitet

```
In[23]:= ListPlot[logAvkastninger, PlotJoined → True,  
  AxesOrigin → {0, 0}, PlotRange → range, PlotStyle → RGBColor[1, 0, 0], AspectRatio → .4];
```



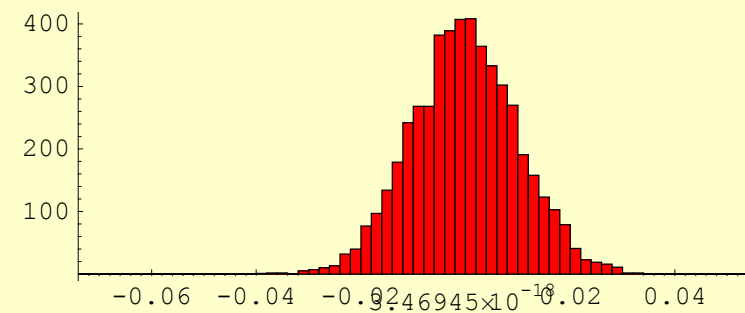
log avkastninger med GARCH(1,1)

```
In[24]:= ListPlot[logAvkastningerGARCH, PlotJoined → True,  
  AxesOrigin → {0, 0}, PlotRange → range, PlotStyle → RGBColor[1, 0, 0], AspectRatio → .4];
```



log avkastninger med konstant volatilitet

```
In[25]:= Histogram[logAvkastninger, HistogramRange -> range, AspectRatio -> .4];
```



log avkastninger med GARCH(1,1)

```
In[26]:= Histogram[logAvkastningerGARCH, HistogramRange -> range, AspectRatio -> .4];
```

