Oppgave 3

PDF premiereserve

Valgte parametre og innleste data

In[1]:=
```
μv = 0.057;
σv = 0.056;
tT = 80;
n = 10 000;
```

In[5]:=
```
farge0 = 1;
```

In[6]:=
```
<< "BarCharts`"; << "Histograms`"; << "PieCharts`"
```

In[71]:=
```
dataGt =
  Take[ReadList["C:\\Users\\psl.AKTUARENE\\Desktop\\STK4500 v08\\Oppgave 3\\betalingsstrom.txt", Numbe
```

Hjelpefunksjoner

In[8]:=
```
transformer = Compile[{{matrise, _Real, 1}}, 1/(e^(μv - σv^2/2) + σv matrise)];
```

In[9]:=
```
folder = Compile[{{matrise, _Real, 1}}, FoldList[#2 #1 &, 1, matrise]];
```

In[10]:=
```
summer = Compile[{{matrise, _Real, 2}}, matrise[[1]].matrise[[2]]];
```

Normalfordeling

In[38]:=

```
simulertPV[antall_] :=
  Module[{dataN01, dataN01ny, simV, simVt, simPV}, dataN01 = RandomReal[NormalDistribution[0, 1], antall t
   dataN01ny = dataN01; simV = Partition[transformer[dataN01ny], tT];
   simVt = Table[folder[simV[[i]]], {i, 1, antall}]; simPV = Table[summer[{simVt[[j]], dataGt}]/10^6, {j, antall}];
```

t-fordeling

In[37]:=

```
simulertPVtFord[antall_, fri_] :=
  Module[{dataT, dataTny, simV, simVt, simPV}, dataT = RandomReal[StudentTDistribution[fri], antall tT];
   dataTny = Sqrt[(fri - 2)/fri] dataT; simV = Partition[transformer[dataTny], tT];
   simVt = Table[folder[simV[[i]]], {i, 1, antall}]; simPV = Table[summer[{simVt[[j]], dataGt}]/10^6, {j, antall}];
```

Plott funksjon

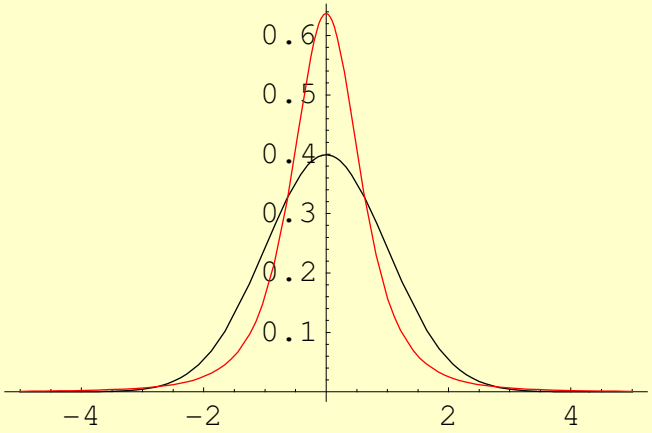
In[72]:=

```
plotT[fri_] :=
  Show[(Plot[StandardDeviation[#1] PDF[#1, x StandardDeviation[#1]], {x, -5, 5}, DisplayFunction → Identit
       RGBColor[farge0 = If[farge0 == 1, 0, 1], 0, 0]] &) /@ {NormalDistribution[0, 1], StudentTDistribution
   DisplayFunction → $DisplayFunction, PlotLabel → "Frihetsgrader: " <> ToString[fri] <> "\tKurtose: " <>
     ToString[1/100.` Round[100 Kurtosis[StudentTDistribution[fri]]]], BaseStyle → {12, FontFamily → "Couri
```

Plott

In[23]:=
```
Do[plotT[fri], {fri, 3, 20}];
```

```
rihetsgrader: 3    Kurtose: Indeterminat
```



Forventning med normalfordeling

Forventning og varians til de stokastiske variablene i eksponenten er like i de to modelllene. Viser at forventningen til Exp av den t
høyere enn Exp av den normalfordelte variablen:

In[24]:=
```
Log[NIntegrate[e^(μv - σv^2/2) + σv x PDF[NormalDistribution[0, 1], x], {x, -10, 10}]]
```

Out[24]=
```
0.057
```

Plottfunksjon: Forventning med t-fordeling

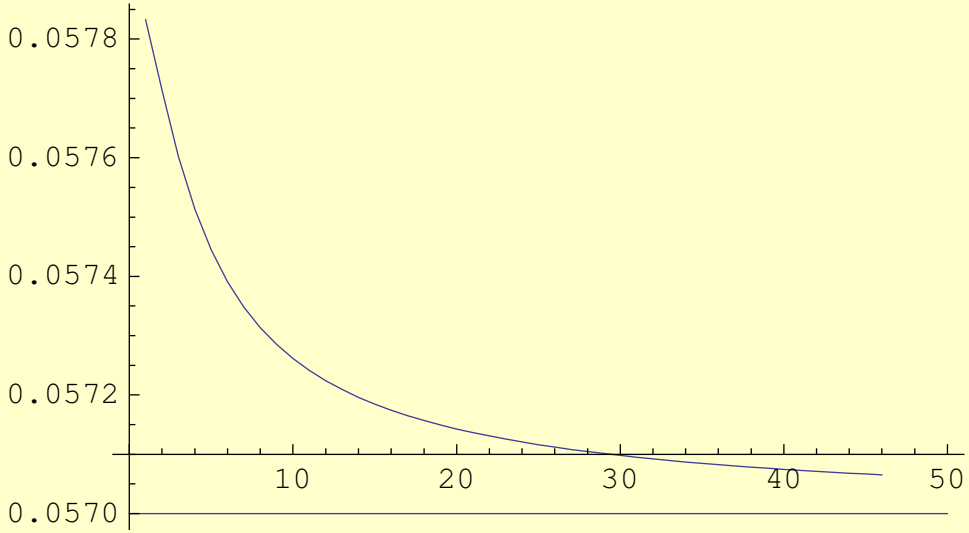
In[25]:=

```
vistForventning :=
 Show[ListPlot[Table[Log[NIntegrate[e^(μv - σv^2/2) + σv x PDF[StudentTDistribution[f], x], {x, -10, 10}]], {f, 5, 50
   PlotRange → All, Joined → True, DisplayFunction → Identity], Plot[0.057`, {x, 0, 50}, DisplayFunction → I
  DisplayFunction → $DisplayFunction, BaseStyle → {12, FontFamily → "Courier"}]
```

Plott: Forventning med t-fordeling

In[27]:=
```
vistForventning
```

Out[27]=



Plottfunksjon

In[30]:=
```
lagHistogram[data_] :=
 Histogram[data, PlotLabel → {"Mean" | Mean[data]
                              "Variance" | Variance[data]
                              "Skjevhet" | Skewness[data]
                              "Haletyngde" | Kurtosis[data]}, HistogramCategories → Table[10 i, {i, 100}],
  BarStyle → RGBColor[1, farge0 = If[farge0 == 1, 0, 1], farge0], ImageSize → 300, BaseStyle → {12, FontFamily
```

Log-avkastninger

In[39]:=
```
Timing[simPV = Flatten[Table[simulertPV[n/100], {100}]];][[1]]
```

Out[39]=
```
0.515
```

In[40]:=
```
Timing[simPVtFord = Flatten[Table[simulertPVtFord[n/100, 5], {100}]];][[1]]
```

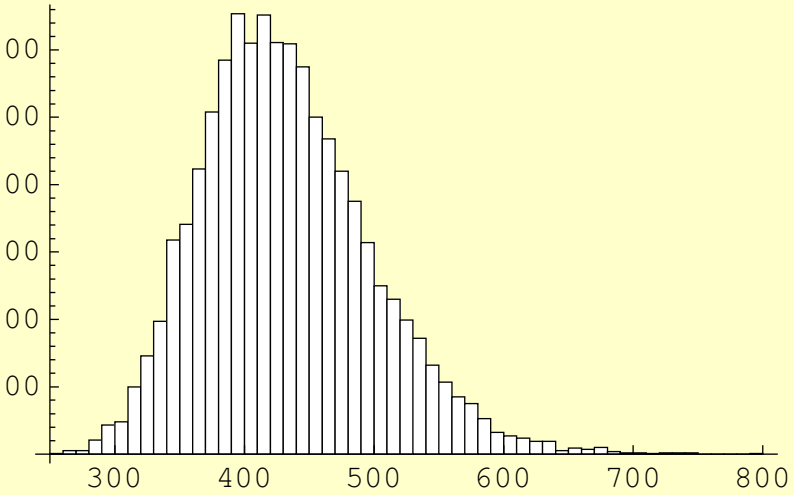
Out[40]=
```
0.686
```

Normalfordelte log-avkastninger

In[42]:=
```
histSimPV = lagHistogram[simPV]
```

Out[42]=
```
msDump`HeadedColumn
```

Mean	43
Variance	42
Skjevhet	0.
Haletyngde	3.

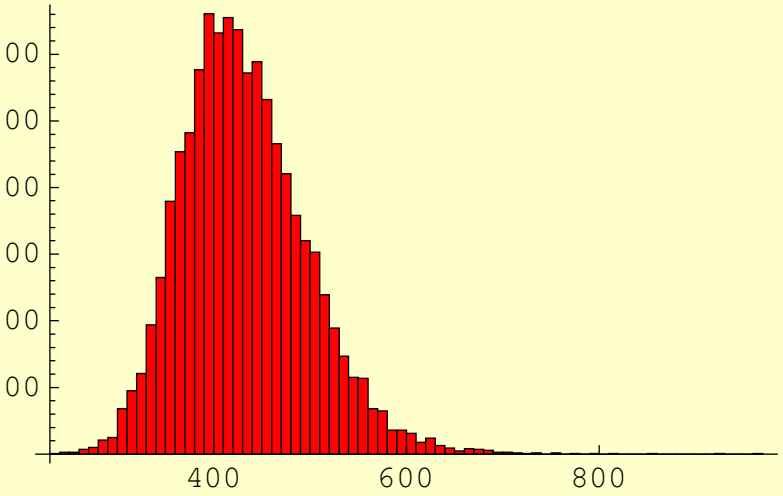


t-fordelte log-avkastninger

In[43]:=
```
histSimPVtFord = lagHistogram[simPVtFord]
```

```
msDump`HeadedColumn({{Mean, 43}, {Variance, 42}, {Skjevhet, 0.}, {Haletyngde, 4.}})
```

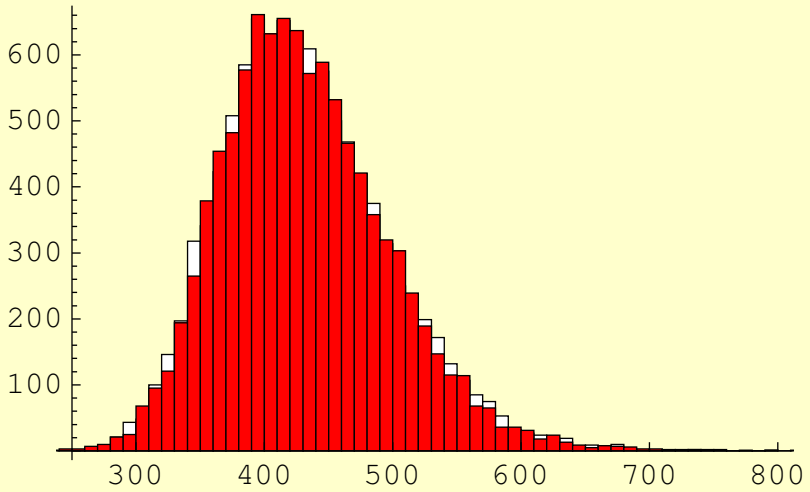
Out[43]=



Sammenlikning

In[45]:=
```
Show[histSimPV, histSimPVtFord, PlotLabel -> ""]
```

Out[45]=



Deterministisk nåverdi med forskjellige diskonteringsrenter (1):

In[46]:=
$$\text{detPV}[\mu\_] := \sum_{i=1}^{tT} \frac{\text{dataGt}[[i]]}{e^{\mu\, i}};$$

In[47]:=
```
dsForm[tall_List] := Table[NumberForm[Round[tall[[i]]], DigitBlock → 3, NumberSeparator → " "], {i, 1, Length
```

In[50]:=
```
renteIntensiteter = {μv, Log[1.04], Log[1.03]};
```

Deterministisk nåverdi med forskjellige diskonteringsrenter (2):

In[51]:=
```
detPVs = detPV[#1] & /@ renteIntensiteter;
```

In[52]:=
```
TableForm[dsForm[detPVs], TableHeadings → {ToString[Exp[#1] - 1] & /@ renteIntensiteter}]
```

Out[52]//TableForm=

0.0586558	392 091 900
0.04	507 986 188
0.03	594 875 174

Kvantiler med forskjellige diskontering (1):

In[53]:=
```
kvantil = Interpolation[Append[
    Prepend[Table[{pr, Take[Sort[simPV], {pr n}]}, {pr, .01, .99, .01}], {0.0, {Min[simPV]}}], {1.0, {Max[s
```

In[54]:=
```
finnKvantil[verdi_] := FindRoot[kvantil[pr] == verdi, {pr, 1./10^6, 1 - 1./10^6}][[1, 2]];
```

Kvantiler med forskjellige diskontering (2):

In[55]:=
```
TableForm[kvantiler = finnKvantil[#1] & /@ detPVs/10^6, TableHeadings → {ToString[Exp[#1] - 1] & /@ renteIntensite
```

Out[55]//TableForm=

0.0586558	0.287702
0.04	0.873003
0.03	0.986786