Oppgave 3

PDF premiereserve

Valgte parametre og innleste data

In[5]:=
```
μv = 0.057;
σv = 0.056;
tT = 80;
n = 10000;
```

In[18]:=
```
farge0 = 1;
```

In[9]:=
```
<< "Statistics`ContinuousDistributions`"
<< "Graphics`Graphics`"
```

In[11]:=
```
dataGt = Take[ReadList["P:\\STK4500\\Oppgaver\\Oppgave 3\\betalingsstrom.txt", Number], tT + 1];
```

Hjelpefunksjoner

In[12]:=
```
transformer = Compile[{{matrise, _Real, 1}}, 1 / e^(μv - σv^2/2) + σv matrise];
```

In[13]:=
```
folder = Compile[{{matrise, _Real, 1}}, FoldList[#2 #1 &, 1, matrise]];
```

In[14]:=
```
summer = Compile[{{matrise, _Real, 2}}, matrise[[1]].matrise[[2]]];
```

Normalfordeling

In[16]:=
```
simulertPV[antall_] :=
  Module[{dataN01, dataN01ny, simV, simVt, simPV}, dataN01 = RandomArray[NormalDistribution[0, 1], antall tT];
   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}]; simPV];
```

t-fordeling

In[21]:=

```
simulertPVtFord[antall_, fri_] :=
  Module[{dataT, dataTny, simV, simVt, simPV}, dataT = RandomArray[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}]; simPV];
```

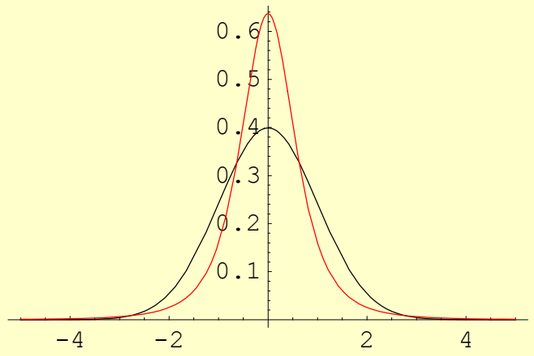
Plott funksjon

In[22]:=
```
plotT[fri_] :=
  Show[(Plot[StandardDeviation[#1] PDF[#1, x StandardDeviation[#1]], {x, -5, 5}, DisplayFunction → Identity, PlotStyle →
        RGBColor[farge0 = If[farge0 == 1, 0, 1], 0, 0]] &) /@ {NormalDistribution[0, 1], StudentTDistribution[fri]},
   DisplayFunction → $DisplayFunction, PlotLabel → "Frihetsgrader: " <> ToString[fri] <> "\tKurtose: " <>
     ToString[Round[100 * Kurtosis[StudentTDistribution[fri]]] / 100.], DefaultFont → {"Courier", 12}];
```

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-fordelte variablen er 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
```

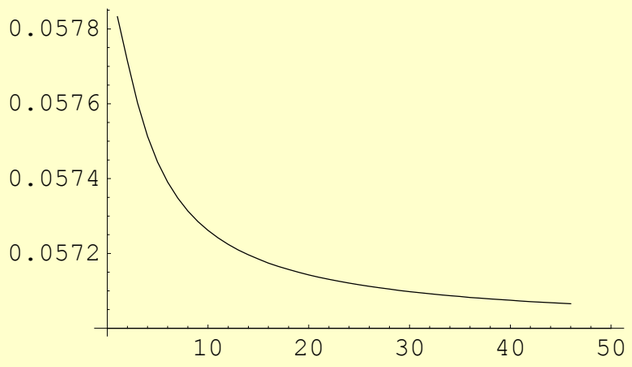
Plottfunksjon: Forventning med t-fordeling

In[28]:=

```
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, PlotJoined → True, DisplayFunction → Identity], Plot[0.057, {x, 0, 50}, DisplayFunction → Identity],
   DisplayFunction → $DisplayFunction, DefaultFont → {"Courier", 12}];
```

Plott: Forventning med t-fordeling

In[30]:=
```
vistForventning;
```



Plottfunksjon

In[40]:=
```
lagHistogram[data_] :=
  Histogram[data, PlotLabel → TableForm[{Mean[data], Variance[data], Skewness[data], Kurtosis[data]},
     TableHeadings → {{"Mean", "Variance", "Skjevhet", "Haletyngde"}, None}],
   HistogramCategories → Table[10 * i, {i, 100}], BarStyle -> RGBColor[1, farge0 = If[farge0 == 1, 0, 1], farge0],
   DefaultFont → {"Courier", 12}, ImageSize → 300];
```

Log-avkastninger

In[32]:=
```
Timing[simPV = Flatten[Table[simulertPV[n/100], {100}]];][[1]]
```

Out[32]=
```
1.662 Second
```

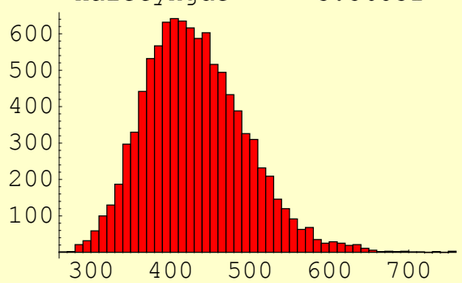
In[33]:=
```
Timing[simPVtFord = Flatten[Table[simulertPVtFord[n/100, 5], {100}]];][[1]]
```

Out[33]=
```
7.15 Second
```

Normalfordelte log-avkastninger

In[41]:=
```
histSimPV = lagHistogram[simPV];
```

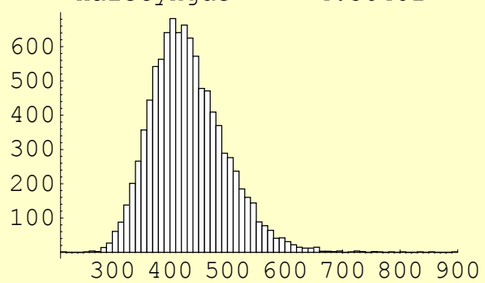
Mean	431.968
Variance	4037.04
Skjevhet	0.546723
Haletyngde	3.56831



t-fordelte log-avkastninger

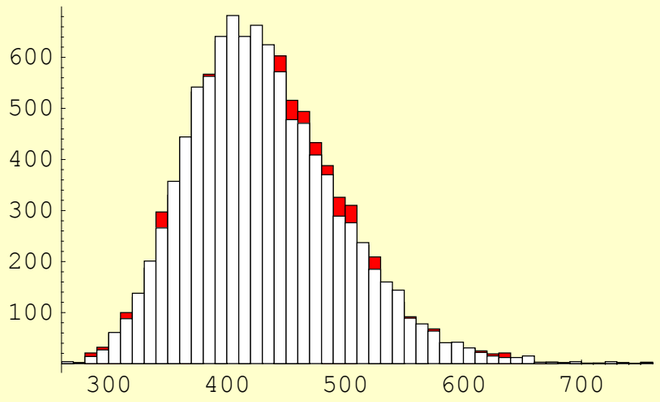
In[42]:=
```
histSimPVtFord = lagHistogram[simPVtFord];
```

Mean	431.797
Variance	4202.15
Skjevhet	0.727005
Haletyngde	4.38481



Sammenlikning

In[43]:=
```
Show[histSimPV, histSimPVtFord, PlotLabel -> ""];
```



Deterministisk nåverdi med forskjellige diskonteringsrenter (1):

In[44]:=
$$\text{detPV}[\mu\_] := \sum_{i=1}^{tT} \frac{\text{dataGt}[[i]]}{e^{\mu\, i}};$$

In[45]:=
```
dsForm[tall_List] := Table[NumberForm[Round[tall[[i]]], DigitBlock → 3, NumberSeparator → " "], {i, 1, Length[tall]}];
```

In[46]:=
```
renteIntensiteter = {μv, Log[1.04], Log[1.03]};
```

Deterministisk nåverdi med forskjellige diskonteringsrenter (2):

In[48]:=
```
detPVs = detPV[#1] & /@ renteIntensiteter;
```

In[49]:=
```
TableForm[dsForm[detPVs], TableHeadings → {ToString[Exp[#1] - 1] & /@ renteIntensiteter}]
```

Out[49]//TableForm=

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

Kvantiler med forskjellige diskontering (1):

In[50]:=
```
kvantil = Interpolation[Append[
    Prepend[Table[{pr, Take[Sort[simPV], {pr n}]}, {pr, .01, .99, .01}], {0.0, {Min[simPV]}}], {1.0, {Max[simPV]}}]];
```

In[51]:=
```
finnKvantil[verdi_] := FindRoot[kvantil[pr] == verdi, {pr, 1./10^6, 1 - 1./10^6}][[1, 2]];
```

Kvantiler med forskjellige diskontering (2):

In[52]:=
```
TableForm[kvantiler = finnKvantil[#1] & /@ detPVs/10^6, TableHeadings → {ToString[Exp[#1] - 1] & /@ renteIntensiteter}]
```

Out[52]//TableForm=

0.0586558	0.28374
0.04	0.882005
0.03	0.987525