Oppgave 2

Aksje/ obligasjon

Valgte parametre

In[6]:=

```
μS = 0.10;
μB = 0.05;
σS = 0.20;
σB = 0.10;
ρ = 0.40;
```

Hjelpefunksjon

Utskrift med valgt antall desimaler:

In[11]:=
```
dsRound[tall_, des_] := N[Round[10^des tall] / 10^des];
```

$$\text{dsRound}[\mathit{tall\_}, \mathit{des\_}] := \text{N}\left[\frac{\text{Round}\left[10^{des}\, \mathit{tall}\right]}{10^{des}}\right];$$

Kumulativ fordelingsfunksjon forholdstall

In[12]:=
```
<< "Statistics`ContinuousDistributions` "
```

In[13]:=

$$\alpha = (\mu S - \mu B) + \sigma B\,(\sigma B - \rho\,\sigma S);$$

$$\beta = \sqrt{\sigma S^2 + \sigma B^2 - 2\,\sigma S\,\sigma B\,\rho}\;;$$

In[15]:=

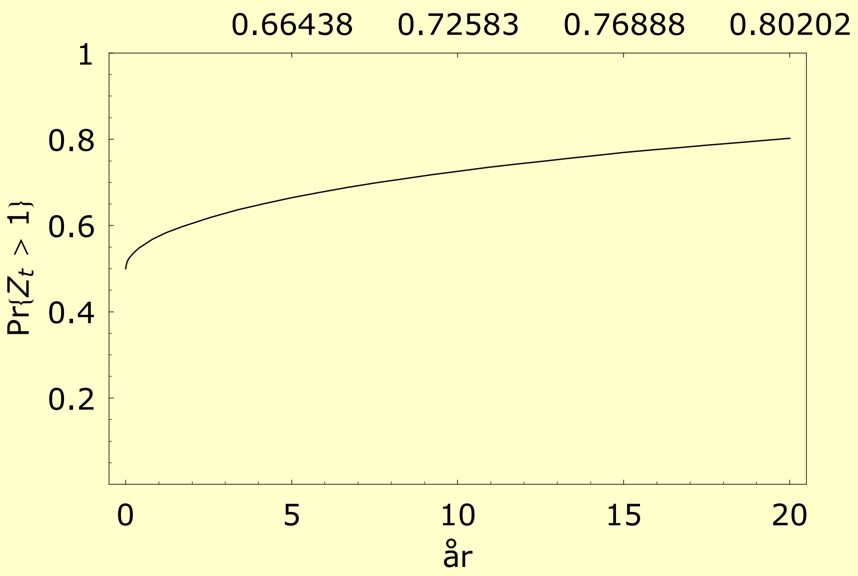
$$pr[k\_,\ t\_] := CDF\left[NormalDistribution[0,1],\ \frac{\left(\alpha - \frac{\beta^2}{2} - \frac{Log[k]}{t}\right)\sqrt{t}}{\beta}\right];$$

Plottfunksjon

In[16]:=
```
lagPlott := Plot[pr[1, t], {t, 0, 20}, PlotRange → {0, 1}, Frame → True,
  FrameTicks → {Automatic, Automatic, Table[{i, ToString[dsRound[pr[1, i], 5]]}, {i, 5, 20, 5}], None},
  FrameLabel → {"år", "Pr{\!\(\*\nStyleBox[SubscriptBox[" Z ",  " t "],\n FontSlant->" Italic
    "]\)\!\(\*\nStyleBox[" ",\n FontSlant->" Italic "]\)> 1}"}, BaseStyle → {11, FontFamily → "Verdana"}]
```

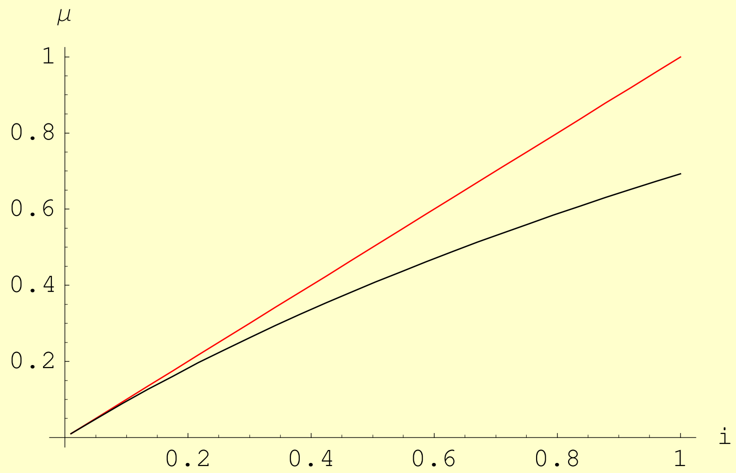
Plott

In[17]:=
```
lagPlott;
```



Fra avkastning til parameter

In[19]:=
```
Plot[{i, Log[1 + i]}, {i, .01, 1}, AxesLabel → {"i", "μ"}, PlotStyle → {RGBColor[1, 0, 0], RGBColor[0, 0, 0]}]
```

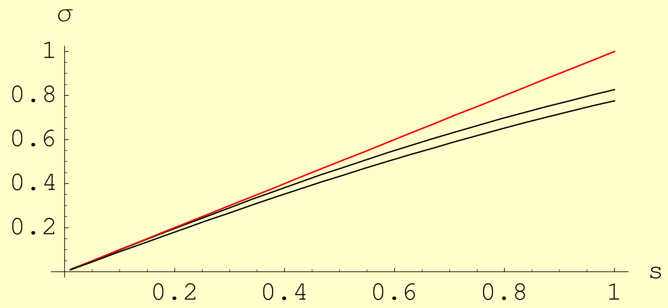


Fra standardavvik til parameter

In[20]:=

```
Plot[Evaluate[Table[{s, Sqrt[Log[1 + (s/(1 + i))^2]]}, {i, .01, .1, .09}]], {s, .01, 1},
  AxesLabel → {"s", "σ"}, AspectRatio → .4, PlotStyle → {RGBColor[1, 0, 0], RGBColor[0, 0, 0]}];
```

$$\text{Plot}\left[\text{Evaluate}\left[\text{Table}\left[\left\{s, \sqrt{\text{Log}\left[1 + \left(\frac{s}{1+i}\right)^2\right]}\right\}, \{i, .01, .1, .09\}\right]\right], \{s, .01, 1\},\right.$$



Klargjør parametre for symbolsk matematikk

In[21]:=
```
Clear[μS, μB, σS, σB, ρ];
```

In[22]:=
```
MatrixForm[Σ = {{1, ρ}, {ρ, 1}}]
```

Out[22]//MatrixForm=

$$\begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}$$

Fra parameter ρ til kovarians

In[23]:=

```
FullSimplify[e^((μS - σS^2/2) + (μB - σB^2/2))
    Integrate[e^(σS x + σB y - 1/2 {x, y}.Inverse[Σ].{x, y}) / Sqrt[(2 π)^2 Det[Σ]], {x, -∞, ∞}, {y, -∞, ∞}, Assumptions → {ρ^2 < 1, σS > 0, σB > 0}] - e^
StyleForm[TraditionalForm[%], FontFamily → "Times", FontSize → 18]
```

Out[24]//StyleForm=

$$e^{\mu B+\mu S}\left(-1+e^{\rho\,\sigma B\,\sigma S}\right)$$

Setter parametere på nytt

In[79]:=
```
<<Statistics`ContinuousDistributions`
```

Nevner for å regne om fra kovarians til korrelasjon:

In[80]:=
```
nevner = StandardDeviation[LogNormalDistribution[μS, σS]] StandardDeviation[LogNormalDistribution[μB, σB]
```

In[81]:=
```
μS = 0.10;
μB = 0.05;
σS = 0.20;
σB = 0.10;
```

Plottfunksjon

Lager funksjon for å sjekke grafisk forholdet mellom parameter ρ og faktisk korrelasjon

In[85]:=

```
lagKorrelasjonsPlott := Plot[{ρ, (e^(μB+μS) (e^(ρ σB σS) - 1))/nevner}, {ρ, -1, 1},
   AxesLabel → {"ρ", "Corr{(S_(t+1) - S_t)/S_t, (B_(t+1) - B_t)/B_t}"}, PlotStyle → {RGBColor[1, 0, 0], RGBColor[0, 0, 0]}];
```

$$\text{lagKorrelasjonsPlott} := \text{Plot}\left[\left\{\rho, \frac{e^{\mu B+\mu S}\left(e^{\rho\,\sigma B\,\sigma S}-1\right)}{\text{nevner}}\right\}, \{\rho, -1, 1\}, \text{AxesLabel} \to \left\{\text{"}\rho\text{"}, \text{"Corr}\left\{\frac{S_{t+1}-S_t}{S_t}, \frac{B_{t+1}-B_t}{B_t}\right\}\text{"}\right\}, \text{PlotStyle} \to \{\text{RGBColor}[1,0,0], \text{RGBColor}[0,0,0]\}\right];$$

Plott

In[86]:=

```
lagKorrelasjonsPlott;
```