Example 1.6: Weather (Section 1.3)

Transition matrix

In[1]:=
```
P := {{0.8, 0.2}, {0.5, 0.5}};
P // MatrixForm
```

Out[2]//MatrixForm=

$$\begin{pmatrix} 0.8 & 0.2 \\ 0.5 & 0.5 \end{pmatrix}$$

Find predictions for future's weather

Initial distribution: on Monday it's cloudy

In[3]:=
```
mu0 := {{1, 0}};
mu0 // MatrixForm
```

Out[4]//MatrixForm=

$$\begin{pmatrix} 1 & 0 \end{pmatrix}$$

Predict Tuesday's weather (1 day ahead)

In[5]:=
```
mu1 := mu0 . P;
mu1 // MatrixForm
```

Out[6]//MatrixForm=

$$\begin{pmatrix} 0.8 & 0.2 \end{pmatrix}$$

Predict Wednesday's weather (2 days ahead)

In[7]:=
```
mu2 := mu0 . P.P;
mu2 // MatrixForm
```

Out[8]//MatrixForm=

$$\begin{pmatrix} 0.74 & 0.26 \end{pmatrix}$$

Predict Saturday's weather (5 days ahead)

In[9]:=
```
mu5 := mu0 . MatrixPower[P, 5];
mu5 // MatrixForm
```

Out[10]//MatrixForm=

$$\begin{pmatrix} 0.71498 & 0.28502 \end{pmatrix}$$

Take unknown initial distribution

Random initial distribution: on Monday it's cloudy/sunny with 50/50 chance

In[11]:=
```
nu0 := {{0.5, 0.5}}
nu0 // MatrixForm
```

Out[12]//MatrixForm=

$$\begin{pmatrix} 0.5 & 0.5 \end{pmatrix}$$

Predict Tuesday's weather (1 day ahead)

In[13]:=
```
nu1 := nu0 . P;
nu1 // MatrixForm
```

Out[14]//MatrixForm=

$$\begin{pmatrix} 0.65 & 0.35 \end{pmatrix}$$

Predict Wednesday's weather (2 days ahead)

In[15]:=
```
nu2 := nu0 . P.P;
nu2 // MatrixForm
```

Out[16]//MatrixForm=

$$\begin{pmatrix} 0.695 & 0.305 \end{pmatrix}$$

Predict Saturday's weather (5 days ahead)

In[17]:=
```
nu5 := nu0 . MatrixPower[P, 5];
nu5 // MatrixForm
```

Out[18]//MatrixForm=

$$\begin{pmatrix} 0.713765 & 0.286235 \end{pmatrix}$$

It seems that, in the long run, the initial distribution didn't matter much! (Cf. Lecture 2)

In[19]:=
```
mu5 // MatrixForm
nu5 // MatrixForm
```

Out[19]//MatrixForm=

$$\begin{pmatrix} 0.71498 & 0.28502 \end{pmatrix}$$

Out[20]//MatrixForm=

$$\begin{pmatrix} 0.713765 & 0.286235 \end{pmatrix}$$