Example: Weather simulation (Section 1.7)

Transition matrix

In[45]:=
```
P := {{0.8, 0.2}, {0.5, 0.5}};
P // MatrixForm
```

Out[46]//MatrixForm=

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

Simulate weather on days 0,1,...,n, if it was cloudy on day 0.

Initial distribution: on Monday it's cloudy

In[47]:=
```
mu0 := {{1, 0}};
mu0 // MatrixForm
```

Out[48]//MatrixForm=

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

Wish to pick Tuesday's weather randomly from transition matrix ("cloudy" row 1)

Matrix element P(1,1) (from cloudy to cloudy):

In[49]:=
```
P11 := Part[P, 1, 1];
P11
```

Out[50]=
```
0.8
```

Matrix element P(1,2) (from cloudy to sunny):

In[51]:=
```
P12 := Part[P, 1, 2];
P12
```

Out[52]=
```
0.2
```

Sanity check: row sum equals one!

In[53]:=
```
P11 + P12
```

Out[53]=
```
1.
```

Construct (pseudo)random variable with probabilities P11 (cloudy) and P12 (sunny)

In[54]:=
```
U := RandomReal[{0, 1}];
```

If U < 0.8, the next day is cloudy, otherwise, the next day is sunny.

In[55]:=
```
V = N[U]
If[V < 0.8, Print["Tuesday is cloudy"] , Print["Tuesday is sunny"] ]
```

Out[55]= 0.121577

Tuesday is cloudy

In[57]:=
```
V
If[V < 0.8, V = N[U]; If[V < 0.8,
   Print["Wednesday is cloudy"] , Print["Wednesday is sunny"] ], V = N[U];
 If[V < 0.5, Print["Wednesday is cloudy"] , Print["Wednesday is sunny"] ]]
V
```

Out[57]= 0.121577

Wednesday is cloudy

Out[59]= 0.26917

Simulate more days

In[60]:=
```
T = Table[Subscript[w, j - 1], {i, 1}, {j, 15}];
T // MatrixForm
```

Out[61]//MatrixForm=

$$\begin{pmatrix} w_0 & w_1 & w_2 & w_3 & w_4 & w_5 & w_6 & w_7 & w_8 & w_9 & w_{10} & w_{11} & w_{12} & w_{13} & w_{14} \end{pmatrix}$$

In[62]:=
```
T[[1, 1]] = 1;
T // MatrixForm
```

Out[63]//MatrixForm=

$$\begin{pmatrix} 1 & w_1 & w_2 & w_3 & w_4 & w_5 & w_6 & w_7 & w_8 & w_9 & w_{10} & w_{11} & w_{12} & w_{13} & w_{14} \end{pmatrix}$$

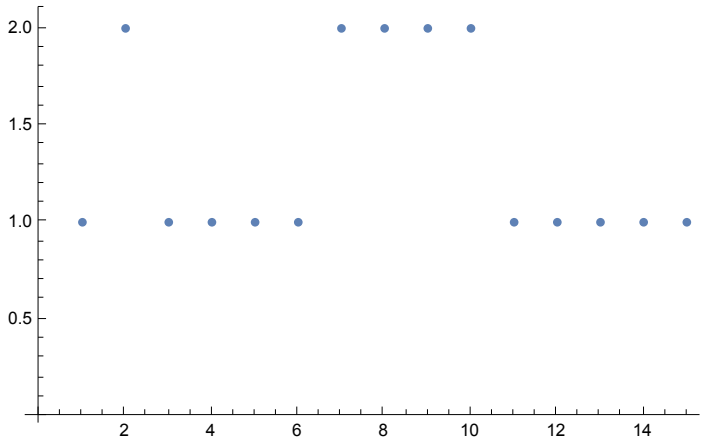
In[64]:=
```
For[n = 1, n < 15, n++,
   V = N[U];
   If[V < 0.8, V = N[U]; If[V < 0.8, T[[1, n + 1]] = 1, T[[1, n + 1]] = 2 ], V = N[U];
    If[V < 0.5, T[[1, n + 1]] = 1 , T[[1, n + 1]] = 2 ]]];
T // MatrixForm
```

Out[65]//MatrixForm=

$$\begin{pmatrix} 1 & 2 & 1 & 1 & 1 & 1 & 2 & 2 & 2 & 2 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}$$

In[66]:=
```
ListPlot[T]
```

Out[66]=



Let's make a larger example!

In[67]:=
```
T = Table[Subscript[w, j - 1], {i, 1}, {j, 100}];
T[[1, 1]] = 1;
```

In[69]:=
```
For[n = 1, n < 100, n++,
  V = N[U];
  If[V < 0.8, V = N[U]; If[V < 0.8, T[[1, n + 1]] = 1, T[[1, n + 1]] = 2 ], V = N[U];
   If[V < 0.5, T[[1, n + 1]] = 1 , T[[1, n + 1]] = 2 ]]];
```

In[70]:=
```
ListPlot[T]
```

Out[70]=