

```
In[1]:= (* load the package Combinatorica *)
In[2]:= Needs["Combinatorica`"]
In[3]:= (* (un)ranking elements of Lists(n) *)
In[4]:= ? RankPerm*
```

RankPermutation[p] gives the rank of permutation p in lexicographic order. >>

```
In[5]:= RankPermutation[Range[9]]
Out[5]= 0

In[6]:= RankPermutation[{1, 9, 2, 3, 7, 6, 4, 5, 8}]
Out[6]= 35 364

In[7]:= UnrankPermutation[9, Range[9]]
Out[7]= {1, 2, 3, 4, 5, 7, 8, 9, 6}

In[8]:= (* generating permutations at random *)
In[9]:= RandomPermutation[9]
Out[9]= {5, 4, 7, 8, 2, 9, 1, 6, 3}

In[10]:= RandomPermutation[9]
Out[10]= {3, 8, 2, 4, 9, 7, 6, 1, 5}

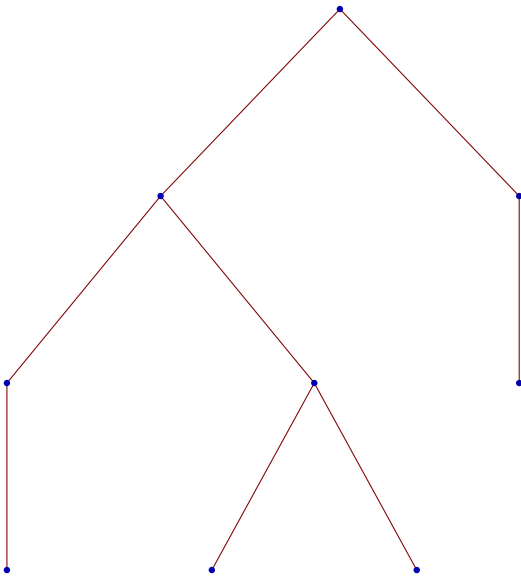
In[11]:= UnrankPermutation[rank = Random[Integer, {0, 9!}], Range[9]]
Out[11]= {7, 5, 1, 8, 2, 4, 3, 6, 9}

In[12]:= rank
Out[12]= 262 566

In[13]:= (* generating trees at random *)
In[14]:= tree = RandomTree[9]
Out[14]= - Graph:< 8,9,Undirected >-
```

```
In[15]:= TreePlot[tree]
```

```
Out[15]=
```



```
In[16]:= (* finding the Pruefer code and its inverse *)
```

```
In[17]:= ? LabeledTreeToCode
```

LabeledTreeToCode[g] reduces the tree g to its Prüfer code. >>

```
In[18]:= ? CodeToLabeledTree
```

CodeToLabeledTree[l] constructs the unique labeled tree on n vertices from the Prüfer code l, which consists of a list of n-2 integers between 1 and n. >>

```
In[19]:= code = LabeledTreeToCode[tree]
```

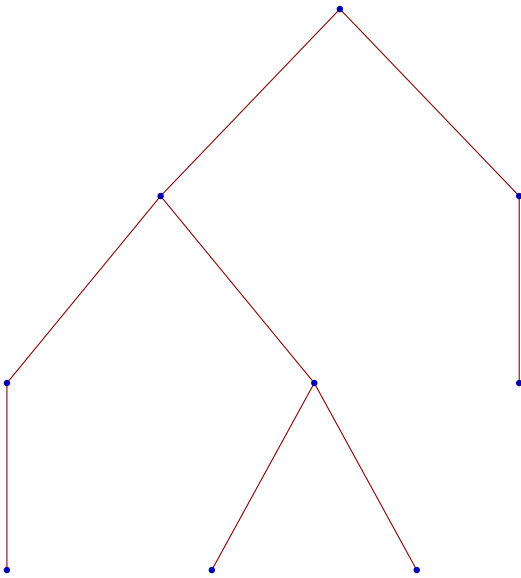
```
Out[19]= {3, 7, 5, 2, 9, 2, 9}
```

```
In[20]:= tree = CodeToLabeledTree[code]
```

```
Out[20]= - Graph:< 8,9,Undirected >-
```

```
In[21]:= TreePlot[tree]
```

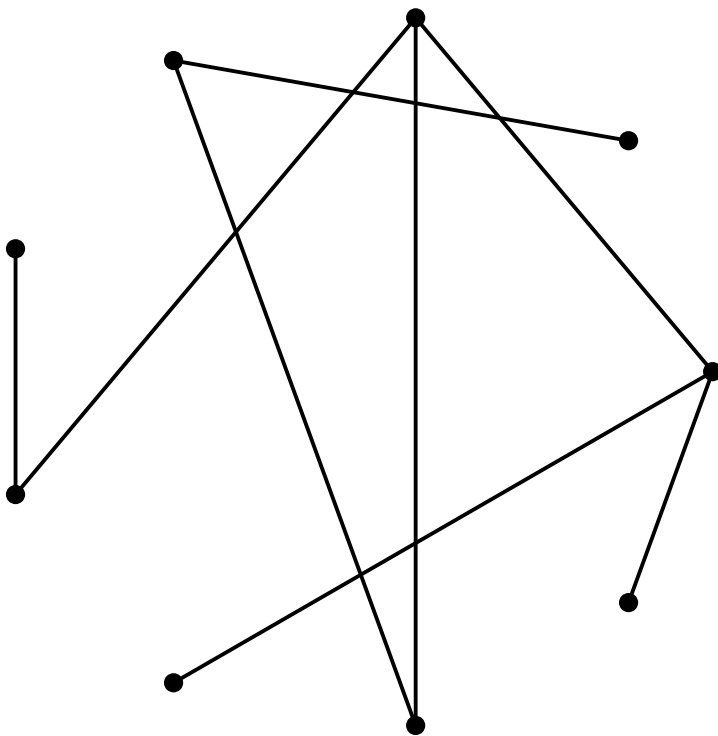
```
Out[21]=
```



```
In[22]:= (* more plotting *)
```

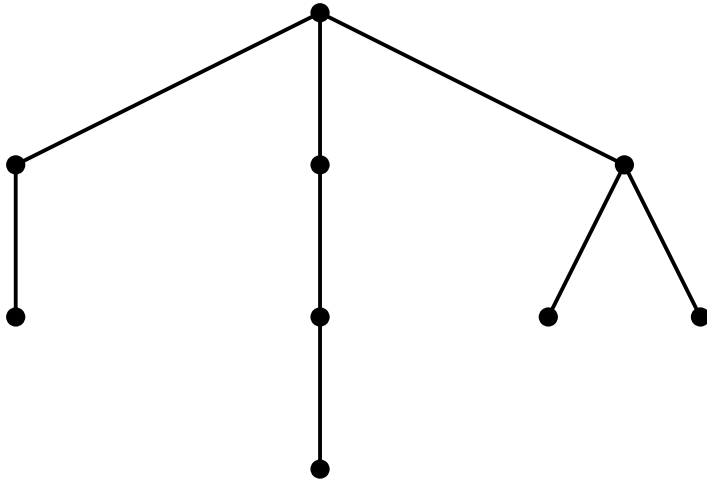
```
In[23]:= ShowGraph[tree]
```

```
Out[23]=
```



```
In[24]:= ShowGraph[RootedEmbedding[tree]]
```

Out[24]=



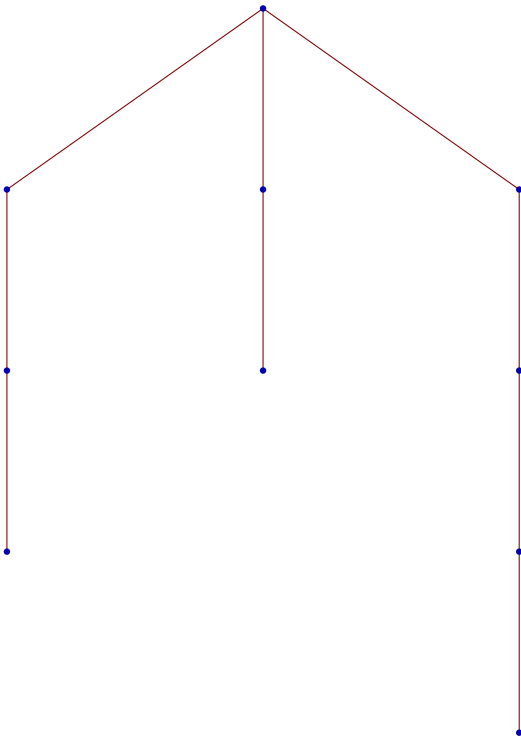
```
In[25]:= code = RandomInteger[{1, 10}, 8]  
tree = CodeToLabeledTree[code]
```

Out[25]= {8, 2, 9, 6, 10, 3, 10, 7}

Out[26]= - Graph:< 9,10,Undirected >-

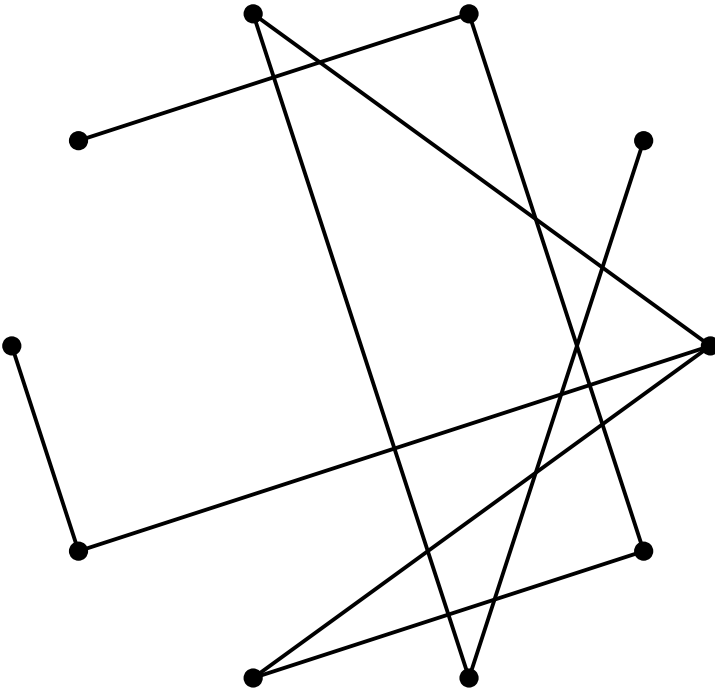
```
In[27]:= TreePlot[tree]
```

```
Out[27]=
```



```
In[28]:= ShowGraph[tree]
```

```
Out[28]=
```



```
In[29]:= (* Stirling numbers *)
```

```
In[30]:= Table[StirlingS1[n, k], {n, 0, 6}, {k, 0, 6}] // TableForm
```

```
Out[30]/TableForm=
```

1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	-1	1	0	0	0	0
0	2	-3	1	0	0	0
0	-6	11	-6	1	0	0
0	24	-50	35	-10	1	0
0	-120	274	-225	85	-15	1

```
In[31]:= Table[StirlingS2[n, k], {n, 0, 6}, {k, 0, 6}] // TableForm
```

```
Out[31]/TableForm=
```

1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	1	1	0	0	0	0
0	1	3	1	0	0	0
0	1	7	6	1	0	0
0	1	15	25	10	1	0
0	1	31	90	65	15	1

```
In[32]:= c[n_, k_] := (-1)^(n+k) StirlingS1[n, k];  
Table[c[n, k], {n, 0, 6}, {k, 0, 6}] // TableForm
```

```
Out[33]/TableForm=
```

1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	1	1	0	0	0	0
0	2	3	1	0	0	0
0	6	11	6	1	0	0
0	24	50	35	10	1	0
0	120	274	225	85	15	1

```
In[34]:=
```