In[7]:=
```
RandomVariate[GaussianOrthogonalMatrixDistribution[3]] // MatrixForm
```

Out[7]//MatrixForm=

$$\begin{pmatrix} 0.269447 & -0.235567 & -0.56972 \\ -0.235567 & -0.0732279 & 0.982845 \\ -0.56972 & 0.982845 & 1.96217 \end{pmatrix}$$

In[8]:=
```
SymmetricMatrixQ[%]
```

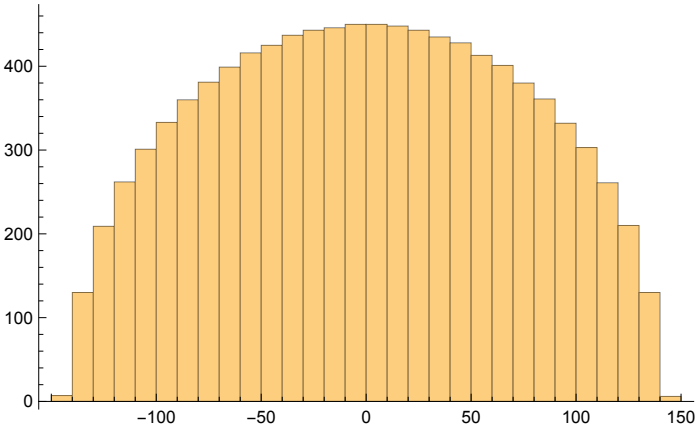
Out[8]= True

In[9]:=
```
UnitaryMatrixQ[%]
```

Out[9]= False

In[4]:=
```
RandomVariate[MatrixPropertyDistribution[Eigenvalues[x],
    x ≃ GaussianOrthogonalMatrixDistribution[10 000]]] // Histogram
```

Out[4]=



In[10]:=
```
RandomVariate[GaussianUnitaryMatrixDistribution[3]] // MatrixForm
```

Out[10]//MatrixForm=

$$\begin{pmatrix} 1.13767 + 0.\,i & 0.854098 + 0.0429364\,i & 0.191238 + 0.067321\,i \\ 0.854098 - 0.0429364\,i & 0.0471076 + 0.\,i & -0.0476739 - 0.267378\,i \\ 0.191238 - 0.067321\,i & -0.0476739 + 0.267378\,i & 0.441105 + 0.\,i \end{pmatrix}$$

In[23]:=
```
SymmetricMatrixQ[RandomVariate[GaussianUnitaryMatrixDistribution[3]]]
```

Out[23]= False

In[24]:=
```
UnitaryMatrixQ[RandomVariate[GaussianUnitaryMatrixDistribution[3]]]
```

Out[24]= False

In[13]:=
```
RandomVariate[GaussianSymplecticMatrixDistribution[3]] // MatrixForm
```

Out[13]//MatrixForm=

$$\begin{pmatrix} 0.548777 + 0.\,i & -0.349871 + 1.20083\,i & -0.544824 + 0.166296\,i & 0. + 0. \\ -0.349871 - 1.20083\,i & -1.30091 + 0.\,i & 1.04332 + 0.2497\,i & -0.131412 + 0.(\\ -0.544824 - 0.166296\,i & 1.04332 - 0.2497\,i & 0.291522 + 0.\,i & 0.757392 + 0.2 \\ 0. + 0.\,i & -0.131412 - 0.0361864\,i & 0.757392 - 0.257043\,i & 0.548777 + \\ 0.131412 + 0.0361864\,i & 0. + 0.\,i & -0.806668 - 1.05001\,i & -0.349871 + 1 \\ -0.757392 + 0.257043\,i & 0.806668 + 1.05001\,i & 0. + 0.\,i & -0.544824 + 0. \end{pmatrix}$$

In[25]:=
```
SymmetricMatrixQ[RandomVariate[GaussianSymplecticMatrixDistribution[3]]]
```

Out[25]= False

In[26]:=
```
UnitaryMatrixQ[RandomVariate[GaussianSymplecticMatrixDistribution[3]]]
```
Out[26]=
```
False
```

In[29]:=
```
A = RandomVariate[CircularUnitaryMatrixDistribution[3]]
```
Out[29]=
```
{{-0.209752 - 0.437657 i, -0.708876 + 0.0508622 i, -0.346836 + 0.372926 i},
 {0.646597 + 0.176965 i, 0.178223 + 0.139082 i, -0.245689 + 0.662665 i},
 {0.457237 - 0.325562 i, -0.115173 + 0.656153 i, -0.0583524 - 0.487584 i}}
```

```
SymmetricMatrixQ[RandomVariate[CircularUnitaryMatrixDistribution[3]]]
```
Out[20]=
```
False
```

In[22]:=
```
UnitaryMatrixQ[RandomVariate[CircularUnitaryMatrixDistribution[3]]]
```
Out[22]=
```
True
```

In[34]:=
```
Chop[A.ConjugateTranspose[A]] // MatrixForm
```
Out[34]//MatrixForm=
$$\begin{pmatrix} 1. & 0 & 0 \\ 0 & 1. & 0 \\ 0 & 0 & 1. \end{pmatrix}$$

In[32]:=
```
B = RandomVariate[CircularOrthogonalMatrixDistribution[3]]
```
Out[32]=
```
{{-0.472582 - 0.222695 i, 0.183289 + 0.50901 i, 0.480986 - 0.4506 i},
 {0.183289 + 0.50901 i, -0.669692 + 0.0481381 i, 0.174639 - 0.475406 i},
 {0.480986 - 0.4506 i, 0.174639 - 0.475406 i, 0.223676 - 0.50899 i}}
```

In[35]:=
```
Chop[B.ConjugateTranspose[B]] // MatrixForm
```
Out[35]//MatrixForm=
$$\begin{pmatrix} 1. & 0 & 0 \\ 0 & 1. & 0 \\ 0 & 0 & 1. \end{pmatrix}$$

In[38]:=
```
C1 = RandomVariate[CircularUnitaryMatrixDistribution[3]]
```
Out[38]=
```
{{-0.507674 - 0.272381 i, -0.415614 - 0.532629 i, 0.192741 + 0.417729 i},
 {0.0967982 + 0.537611 i, 0.493587 - 0.312238 i, 0.501839 + 0.329607 i},
 {0.310466 - 0.522772 i, -0.00249666 + 0.449938 i, 0.550177 + 0.353802 i}}
```

In[39]:=
```
Chop[C1.ConjugateTranspose[C1]] // MatrixForm
```
Out[39]//MatrixForm=
$$\begin{pmatrix} 1. & 0 & 0 \\ 0 & 1. & 0 \\ 0 & 0 & 1. \end{pmatrix}$$

In[46]:=
```
D1 = Chop[RandomVariate[CircularSymplecticMatrixDistribution[3]]]
```

Out[46]=
```
{{0.603207 - 0.412394 i, 0.530521 - 0.194541 i,
  -0.100215 - 0.262651 i, 0, 0.199717 + 0.128518 i, 0.0485042 - 0.0948079 i},
 {-0.345448 - 0.271705 i, 0.522907 + 0.283278 i, 0.211005 + 0.432946 i,
  -0.199717 - 0.128518 i, 0, 0.391677 + 0.106695 i},
 {0.391597 + 0.176412 i, 0.0418731 - 0.388466 i, -0.114293 + 0.688239 i,
  -0.0485042 + 0.0948079 i, -0.391677 - 0.106695 i, 0},
 {0, 0.0372997 - 0.169935 i, 0.0946027 - 0.221872 i, 0.603207 - 0.412394 i,
  -0.345448 - 0.271705 i, 0.391597 + 0.176412 i},
 {-0.0372997 + 0.169935 i, 0, -0.0943301 + 0.36769 i,
  0.530521 - 0.194541 i, 0.522907 + 0.283278 i, 0.0418731 - 0.388466 i},
 {-0.0946027 + 0.221872 i, 0.0943301 - 0.36769 i, 0, -0.100215 - 0.262651 i,
  0.211005 + 0.432946 i, -0.114293 + 0.688239 i}}
```

In[48]:=
```
Chop[D1.ConjugateTranspose[D1]] // MatrixForm
```

Out[48]//MatrixForm=

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