In[1]:=
```
(* Here is a matrix that is block diagonalized: *)

dd =
 {{2, 1, 0},
  {0, 2, 0},
  {0, 0, 3}}
```

Out[1]= $\{\{2, 1, 0\}, \{0, 2, 0\}, \{0, 0, 3\}\}$

In[2]:=
```
MatrixForm[dd]
```

Out[2]//MatrixForm=

$$\begin{pmatrix} 2 & 1 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$$

In[3]:=
```
(* Now I want to disguise it. *)
```

In[7]:=
```
ss = Table[RandomInteger[{-2, 2}], {3}, {3}]
```

Out[7]= $\{\{-2, -2, 2\}, \{0, 0, 2\}, \{-1, -2, 0\}\}$

In[8]:=
```
MatrixForm[ss]
```

Out[8]//MatrixForm=

$$\begin{pmatrix} -2 & -2 & 2 \\ 0 & 0 & 2 \\ -1 & -2 & 0 \end{pmatrix}$$

In[9]:=
```
Det[ss]
```

Out[9]= -4

In[11]:=
```
xx = ss.dd.Inverse[ss]
```

Out[11]= $\left\{\{1, 2, 2\}, \{0, 3, 0\}, \left\{-\frac{1}{2}, \frac{1}{2}, 3\right\}\right\}$

In[12]:=
```
MatrixForm[xx]
```

Out[12]//MatrixForm=

$$\begin{pmatrix} 1 & 2 & 2 \\ 0 & 3 & 0 \\ -\frac{1}{2} & \frac{1}{2} & 3 \end{pmatrix}$$

In[13]:=
```
CharacteristicPolynomial[xx, t]
```

Out[13]= $12 - 16\,t + 7\,t^2 - t^3$

In[14]:=
```
Factor[12 - 16 t + 7 t^2 - t^3]
```

Out[14]= $-\left((-3 + t)\ (-2 + t)^2\right)$

```
(* The characteristic polynomial factors as (t-2)^2 (t-3). *)

(* So we should be able to block diagonalize xx so that one
  block has char. poly (t-2)^2 and the other has char. poly t-3. *)
```