Problem 2

In[1]:= `A = {{0, 4, 0}, {4, 0, 1}, {0, 1, 0}}`

Out[1]= $\{\{0, 4, 0\}, \{4, 0, 1\}, \{0, 1, 0\}\}$

In[2]:=
```
Eigenvals = Eigenvalues[A]
Eigenvecs = Eigenvectors[A]
```

Out[2]= $\{-\sqrt{17}, \sqrt{17}, 0\}$

Out[3]= $\{\{4, -\sqrt{17}, 1\}, \{4, \sqrt{17}, 1\}, \{-1, 0, 4\}\}$

In[4]:=
```
NormedVecs =
 {Normalize[Eigenvecs[[1]]], Normalize[Eigenvecs[[2]]], Normalize[Eigenvecs[[3]]]}
```

Out[4]= $\left\{\left\{2\sqrt{\frac{2}{17}}, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{34}}\right\}, \left\{2\sqrt{\frac{2}{17}}, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{34}}\right\}, \left\{-\frac{1}{\sqrt{17}}, 0, \frac{4}{\sqrt{17}}\right\}\right\}$

In[5]:= ϵ_0 `= {0, 0, 1}`

Out[5]= $\{0, 0, 1\}$

In[6]:= `Norm[Dot[NormedVecs[[1]],` ϵ_0`]]^2`

Out[6]= $\frac{1}{34}$

In[7]:= `Norm[Dot[NormedVecs[[2]],` ϵ_0`]]^2`

Out[7]= $\frac{1}{34}$

In[8]:= `Norm[Dot[NormedVecs[[3]],` ϵ_0`]]^2`

Out[8]= $\frac{16}{17}$

Problem 5

In[9]:=
```
A = {{1, 0, 0}, {0, 0, 1}, {0, 1, 0}}
B = {{0, 0, -1}, {0, 0, i}, {-1, -i, 4}}
C' = {{2, 0, 0}, {0, 1, 3}, {0, 3, 1}}
```

Out[9]= $\{\{1, 0, 0\}, \{0, 0, 1\}, \{0, 1, 0\}\}$

Out[10]= $\{\{0, 0, -1\}, \{0, 0, i\}, \{-1, -i, 4\}\}$

Out[11]= $\{\{2, 0, 0\}, \{0, 1, 3\}, \{0, 3, 1\}\}$

In[12]:=
```
MatrixForm[A.B - B.A]
```

Out[12]//MatrixForm=

$$\begin{pmatrix} 0 & 1 & -1 \\ -1 & -2\,i & 4 \\ 1 & -4 & 2\,i \end{pmatrix}$$

In[13]:=
```
MatrixForm[A.C' - C'.A]
```

Out[13]//MatrixForm=

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

In[14]:=
```
MatrixForm[B.C' - C'.B]
```

Out[14]//MatrixForm=

$$\begin{pmatrix} 0 & -3 & 1 \\ 3 & 6\,i & -12 \\ -1 & 12 & -6\,i \end{pmatrix}$$

In[15]:=

In[16]:=
```
Avals = Eigenvalues[A]
Bvals = Eigenvalues[B]
Cvals = Eigenvalues[C']
Avecs = Eigenvectors[A]
Bvecs = Eigenvectors[B]
Cvecs = Eigenvectors[C']
```

Out[16]= $\{-1, 1, 1\}$

Out[17]= $\{2+\sqrt{6}, 2-\sqrt{6}, 0\}$

Out[18]= $\{4, -2, 2\}$

Out[19]= $\{\{0, -1, 1\}, \{0, 1, 1\}, \{1, 0, 0\}\}$

Out[20]= $\left\{\left\{-\frac{1}{2+\sqrt{6}}, \frac{i}{2+\sqrt{6}}, 1\right\}, \left\{\frac{1}{-2+\sqrt{6}}, -\frac{i}{-2+\sqrt{6}}, 1\right\}, \{-i, 1, 0\}\right\}$

Out[21]= $\{\{0, 1, 1\}, \{0, -1, 1\}, \{1, 0, 0\}\}$

In[22]:=
```
Avecs = {Normalize[Avecs[[1]]], Normalize[Avecs[[2]]], Normalize[Avecs[[3]]]}
Bvecs = {Normalize[Bvecs[[1]]], Normalize[Bvecs[[2]]], Normalize[Bvecs[[3]]]}
Cvecs = {Normalize[Cvecs[[1]]], Normalize[Cvecs[[2]]], Normalize[Cvecs[[3]]]}
```

Out[22]= $\left\{\left\{0, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right\}, \left\{0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right\}, \{1, 0, 0\}\right\}$

Out[23]= $\left\{\left\{-\frac{1}{\left(2+\sqrt{6}\right)\sqrt{1+\frac{2}{\left(2+\sqrt{6}\right)^2}}}, \frac{i}{\left(2+\sqrt{6}\right)\sqrt{1+\frac{2}{\left(2+\sqrt{6}\right)^2}}}, \frac{1}{\sqrt{1+\frac{2}{\left(2+\sqrt{6}\right)^2}}}\right\},\right.$
$\left\{\frac{1}{\left(-2+\sqrt{6}\right)\sqrt{1+\frac{2}{\left(-2+\sqrt{6}\right)^2}}}, -\frac{i}{\left(-2+\sqrt{6}\right)\sqrt{1+\frac{2}{\left(-2+\sqrt{6}\right)^2}}}, \frac{1}{\sqrt{1+\frac{2}{\left(-2+\sqrt{6}\right)^2}}}\right\},$
$\left.\left\{-\frac{i}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right\}\right\}$

Out[24]= $\left\{\left\{0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right\}, \left\{0, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right\}, \{1, 0, 0\}\right\}$

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