In[319]:=
```
(* Define the matrices of Alice and Bob. *)
```
$$X = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix};$$
$$Z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix};$$
```
A = Z;
B = (X + Z) / Sqrt[2];
```

In[323]:=
```
(* Calculate their eigenvalues and -vectors. *)
eigA = Eigensystem[A];
λa1 = eigA[[1, 1]];
va1 = eigA[[2, 1]];
λa2 = eigA[[1, 2]];
va2 = eigA[[2, 2]];

eigB = Eigensystem[B];
λb1 = eigB[[1, 1]];
vb1 = eigB[[2, 1]];
λb2 = eigB[[1, 2]];
vb2 = eigB[[2, 2]];
```

In[333]:=
```
(* Eigenvalues and -vectors of A. *)
{λa1, va1}
{λa2, va2}
```

Out[333]= {-1, {0, 1}}

Out[334]= {1, {1, 0}}

In[335]:=
```
(* Eigenvalues and -vectors of B. *)
{λb1, vb1}
{λb2, vb2}
```

Out[335]= $\left\{-1, \left\{1 - \sqrt{2}, 1\right\}\right\}$

Out[336]= $\left\{1, \left\{1 + \sqrt{2}, 1\right\}\right\}$

In[337]:=
```
(* The tensor products of the above eigenvectors are equivalent
 to the eigenvectors of the tensor product of the matrices. *)
eigAB = Eigensystem[KroneckerProduct[A, B]];
λ1 = eigAB[[1, 1]];
v1 = eigAB[[2, 1]] / Norm[v1];
λ2 = eigAB[[1, 2]];
v2 = eigAB[[2, 2]] / Norm[v2];
λ3 = eigAB[[1, 3]];
v3 = eigAB[[2, 3]] / Norm[v3];
λ4 = eigAB[[1, 4]];
v4 = eigAB[[2, 4]] / Norm[v4];
```

In[346]:=
```
(* Define the Bell state. *)
ψ = ({1, 0, 0, 0} + {0, 0, 0, 1}) / Sqrt[2];
```

In[347]:=
```
FullSimplify[λ1 * Abs[v1.ψ]^2 + λ2 * Abs[v2.ψ]^2 + λ3 * Abs[v3.ψ]^2 + λ4 * Abs[v4.ψ]^2]
FullSimplify[ψ.KroneckerProduct[A, B].ψ]
```

Out[347]= $\frac{1}{\sqrt{2}}$

Out[348]= $\frac{1}{\sqrt{2}}$