

```
In[1]:= A = {{a11, a12}, {a21, a22}};
        B = {{b11, b12}, {b21, b22}};
        ρ = {{ρ11, ρ12}, {ρ21, ρ22}};
        ρv = Flatten[ρ];
```

```
In[5]:= A
```

```
Out[5]= {{a11, a12}, {a21, a22}}
```

```
In[6]:= B
```

```
Out[6]= {{b11, b12}, {b21, b22}}
```

```
In[7]:= ρ
```

```
Out[7]= {{ρ11, ρ12}, {ρ21, ρ22}}
```

```
In[8]:= ρv
```

```
Out[8]= {ρ11, ρ12, ρ21, ρ22}
```

```
In[9]:= AB = KroneckerProduct[A, Transpose[B]]
```

```
Out[9]= {{a11 b11, a11 b21, a12 b11, a12 b21}, {a11 b12, a11 b22, a12 b12, a12 b22},
          {a21 b11, a21 b21, a22 b11, a22 b21}, {a21 b12, a21 b22, a22 b12, a22 b22}}
```

```
In[10]:= Flatten[A.ρ.B] // Simplify // MatrixForm
```

```
Out[10]//MatrixForm=
```

$$\begin{pmatrix} a_{11} b_{11} \rho_{11} + a_{11} b_{21} \rho_{12} + a_{12} b_{11} \rho_{21} + a_{12} b_{21} \rho_{22} \\ a_{11} b_{12} \rho_{11} + a_{11} b_{22} \rho_{12} + a_{12} b_{12} \rho_{21} + a_{12} b_{22} \rho_{22} \\ a_{21} b_{11} \rho_{11} + a_{21} b_{21} \rho_{12} + a_{22} b_{11} \rho_{21} + a_{22} b_{21} \rho_{22} \\ a_{21} b_{12} \rho_{11} + a_{21} b_{22} \rho_{12} + a_{22} b_{12} \rho_{21} + a_{22} b_{22} \rho_{22} \end{pmatrix}$$

```
In[11]:= AB . ρv // MatrixForm
```

```
Out[11]//MatrixForm=
```

$$\begin{pmatrix} a_{11} b_{11} \rho_{11} + a_{11} b_{21} \rho_{12} + a_{12} b_{11} \rho_{21} + a_{12} b_{21} \rho_{22} \\ a_{11} b_{12} \rho_{11} + a_{11} b_{22} \rho_{12} + a_{12} b_{12} \rho_{21} + a_{12} b_{22} \rho_{22} \\ a_{21} b_{11} \rho_{11} + a_{21} b_{21} \rho_{12} + a_{22} b_{11} \rho_{21} + a_{22} b_{21} \rho_{22} \\ a_{21} b_{12} \rho_{11} + a_{21} b_{22} \rho_{12} + a_{22} b_{12} \rho_{21} + a_{22} b_{22} \rho_{22} \end{pmatrix}$$