2.1 Mathematical Representation of Multiple Qubits

1. Find each of the following

(a) $\left(\frac{\sqrt{3}}{2}|0\rangle + \frac{1}{2}|1\rangle\right) \otimes \left(\frac{1}{\sqrt{2}}|0\rangle + \frac{1}{\sqrt{2}}|1\rangle\right)$

(b) $\left(\alpha|0\rangle + \beta|1\rangle\right) \otimes \left(\gamma|0\rangle + \delta|1\rangle\right)$

(c) $\left(\alpha|0\rangle + \beta|1\rangle\right) \otimes |0\rangle$

2. Expand the state $|0\rangle^{\otimes 2} \otimes |1\rangle^{\otimes 3} \otimes |0\rangle$

Answers

1.

(a) $\frac{\sqrt{3}}{2\sqrt{2}}|00\rangle + \frac{\sqrt{3}}{2\sqrt{2}}|01\rangle + \frac{1}{2\sqrt{2}}|10\rangle + \frac{1}{2\sqrt{2}}|11\rangle$

(b) $\alpha\gamma|00\rangle + \alpha\delta|01\rangle + \beta\gamma|10\rangle + \beta\delta|11\rangle$

(c) $\alpha|00\rangle + \beta|10\rangle$

2. $|001110\rangle$