

Solution to QCQI

JOJO

2 Introduction to quantum mechanics

Exercise 2.1

Answer:

Since

$$(1, -1) + (1, 2) - (2, 1) = 0$$

Thus $(1, -1)$, $(1, 2)$ and $(2, 1)$ are linearly dependent.

Exercise 2.2

Answer:

$A = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ w.r.t. the input basis $|0\rangle, |1\rangle$ and output basis $|0\rangle, |1\rangle$. If we take output basis as $\frac{|0\rangle+|1\rangle}{\sqrt{2}}, \frac{|0\rangle-|1\rangle}{\sqrt{2}}$, matrix representation of A is

$$A = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$$

Exercise 2.3

Answer: omitted.