LaPierre - Introduction to Quantum Computing (2022)

Errata

#errata

- p. 65, sec. 4.7 :
  This section is mostly incorrect and confusion.

  The symbol $\otimes$ is usually used in quantum mechanics to denote the Kronecker tensor product, and the outer product is never needed. Moreover, eq. (4.23) is incorrect because the outer product combines two vectors (kets) in a matrix, not a vector and a co-vector (ket and bra).

  Next, the following sentence is incorrect and must be removed:
  “Note that we can't apply the usual rules for matrix multiplication here: it makes no sense to multiply a 2×1 matrix by a 1×2 matrix.”
  This is not true because matrix multiplication requires the number of columns of the first matrix to match the number of rows of the second matrix. Here, both are equal to 1, so they can be multiplied, and the result is exactly the RHS of (4.23).
  See for example the Wikipédia page on the outer product.

  Hence, in the the notation of the section, we should write:

  $$|\psi\rangle\langle\phi| = |\psi\rangle \otimes |\phi\rangle = \begin{pmatrix}\alpha\\ \beta\end{pmatrix} \otimes \begin{pmatrix}\delta\\ \epsilon\end{pmatrix} = \begin{pmatrix}\alpha\\ \beta\end{pmatrix} \begin{pmatrix}\delta^* & \epsilon^*\end{pmatrix} = \begin{pmatrix}\alpha\delta^* & \alpha\epsilon^*\\ \beta\delta^* & \beta\epsilon^*\end{pmatrix}$$

  Also note that the β in the lower left component is not written in italics.

  Later, in chapter 9 (see in particular eq. (9.7), the author introduces the usual (Kronecker) tensor product, and this one is not needed anywhere.
  (01/03/2023)

- p. 106, sec. 7.7 :
  “An operator is said (...) ~~is~~ it is equal to” → if
  (01/03/2023)

- p. 117, sec. 7.18 :
  The CPHASE gate involves a generic phase ϕ, like the PHASE gate from sec. 7.15.
  There is also a typo in the matrix.

“For example, the control-Z (also called CZ ~~or CPHASE~~) gate (...). The transformation matrix for the ~~CPHASE~~ gate is:

$$\mathrm{CPHASE} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & -1 \end{pmatrix} = \cdots$$

Exercise 7.14 Show that the ~~CPHASE~~ is symmetric (...)”
→ “For example, the control-Z (also called CZ) gate (...). The transformation matrix for the CZ gate is:

$$\mathrm{CZ} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -1 \end{pmatrix} = \cdots$$

Exercise 7.14 Show that the CZ is symmetric (...)”

(01/03/2023)

- p. 197, sec. 14.2 :
“as described by the ~~time-independent~~ ~~Schrodinger~~ equation” → “as described by the Schrödinger equation”
(01/03/2023)

- p. 200, eq. (14.34) :
The second equality is confusing and not useful :

$$\omega_0 = \cdots = \frac{1}{\mathrm{d}t} \frac{\mathrm{d}S}{S \sin\theta} = \cdots$$

(01/03/2023)

- p. 275, sec. 21.1 :
“Wolfgang Paul (Nobel Prize in Physics in ~~1945~~)”
→ “Wolfgang Paul (Nobel Prize in Physics in ~~1989~~)”
(1945 was Wolgang Pauli)
(01/03/2023)

- p. 316, sec. 22.15 :
“with the chare qubit” → “charge”
(01/03/2023)