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Errata: A Quantum Computation Workbook

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Chapter 1

Postulates of Quantum Mechanics

Problem 1.10 (a), p. 30 The words “first” and “second” in the statements must be exchanged (p_2 should also be replaced with p_1 to be consistent with the rest subquestions). The correct statement should read as

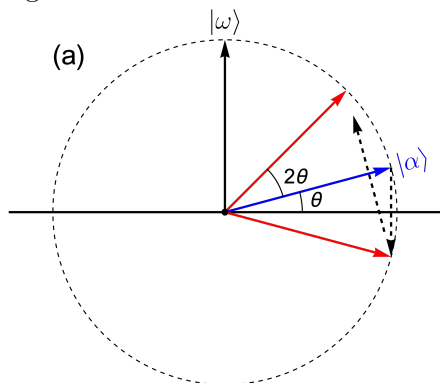
What is the probability p_0 to find the *second* qubit in $|0\rangle$ (regardless of the *first* qubit)? Similarly, what is the probability p_1 to find the *second* qubit in the state $|1\rangle$?

Chapter 4

Quantum Algorithms

Fig. 4.4b, p. 179 “... with respect to ω ...” \rightarrow “... with respect to $|v\rangle$...”

Fig. 4.5a, p. 182 $\theta, \theta/2 \rightarrow 2\theta, \theta$, respectively. Here is the correct figure for Fig. 4.5a:



Section 4.4, p. 161, below Eq. (4.64) “... performing the transformation \hat{U} repeatedly depending on the value y on the native register.” \rightarrow “... performing the transformation \hat{U} repeatedly depending on value x on the native register.”

Problem 4.1 (a) “Classically (...), ...” \rightarrow “Show that classically (...), ...”.

Chapter 5

Quantum Decoherence

Section 5.1 In several places, “Zender” must be corrected to “Zehnder”.

Section 5.1, p. 191, the last line “In the blue arm, photon passes through ...”
→ “In the red arm, photon passes through ...”.

Section 5.1, p. 194, below Eq. (5.6) “Whence the photon detection probabilities ...” → “Hence the photon detection probabilities...”.

Fig. 5.4, p. 208, line 3 of the caption “... the success probability is $1/4$...”
→ “... the success probability is $1/d^2$ for $d = \dim \mathcal{V}$...”.

Section 5.2, p. 209, line 1 “... a success probability of $1/4$...” → “... a success probability of $1/d^2$ for $d = \dim \mathcal{V}$...”.

Section 5.2, p. 209, line 10 from top “... a success probability of $1/4$...” → “... a success probability of $1/d^2$...”.

Section 5.3, p. 216, line 8 “...probabilities $\mathcal{F}_m(\hat{\rho})$ ” must reads as “...probabilities $\text{Tr}[\mathcal{F}_m(\hat{\rho})]$ ”.

Section 5.4, Eq. (5.99) It should read as

$$\hat{G} = \frac{1}{2} \sum_{\mu > 0} \hat{L}_{\mu}^{\dagger} \hat{L}_{\mu} .$$

Section 5.4, Eq. (5.147) It should read as

$$\frac{d\hat{\rho}}{dt} = \dots .$$

Section 5.5, the first sentence, p. 234 “..., who close (or different) ...” → “..., how close (or different) ...”.

Section 5.5, p. 236, just below Eq. (5.164) “... the canonical norm associate with ...” → “... the canonical norm associated with ...”.

Section 5.5, p. 237, just below Eq. (5.177) “... traceless Hermitian operators (a_0) ...” \rightarrow “... traceless Hermitian operators ($a_0 = 0$) ...”.

Section 5.5, p. 244, the first line “associate with a POVM ...” \rightarrow “associated with a POVM ...”.

Section 5.5, p. 247, below Eq. (5.209) “... of two vectors normalized vectors ...” \rightarrow “... of two normalized vectors ...”.

Section 5.5, p. 248, below Eq. (5.215) “... to note that $\hat{\rho}$ as two eigenvalues ...” \rightarrow “... to note that $\hat{\rho}$ has two eigenvalues ...”.

Sectoin 5.5, p. 249, Eq. (5.224) It should reads

$$\dots \geq \left| (\langle \Psi | \otimes \langle \epsilon_0 |) \hat{U} \hat{U}^\dagger (|\Phi\rangle \otimes |\epsilon_0\rangle) \right| = \dots .$$

Problem 5.4, p. 252, Eq.(5.234) $\gamma_1 \rightarrow \gamma_\phi$

Chapter 6

Quantum Error-Correction Codes

Section 6.3, p. 288. Eq. (6.75)

$$\hat{U}(|0\rangle \otimes |\alpha\rangle) = |0\rangle \otimes |\alpha_0\rangle + |1\rangle \otimes \hat{A}|\alpha_1\rangle = \dots$$

must be changed to

$$\hat{U}(|0\rangle \otimes |\alpha\rangle) = |0\rangle \otimes |\alpha_0\rangle + |1\rangle \otimes \hat{A}|\alpha_0\rangle = \dots .$$

Section 6.4, p. 298, above Eq. (6.101) “whence” \rightarrow “hence”.

Appendix A

Linear Algebra

Appendix A.1, p. 350, Definition A.3 “... there exists a solution ...” \rightarrow “... there exists a non-trivial solution ...”

Appendix A.1, p. 351, above Eq. (A.5) “Whence u is orthogonal ...” \rightarrow “Hence u is orthogonal ...”.

Appendix A.4, p. 364, above Eq. (A.55) “Whence, $\hat{A} \geq 0$.” \rightarrow “Hence, $\hat{A} \geq 0$.”

Appendix A.4, p. 363, below Eq. (A.59) “... eigenvalues ± 1 ” \rightarrow “... eigenvalues $e^{\mp i\phi}$ ”.

Appendix A.6, p. 369, below Eq. (A.79) $N := \mathcal{W} \rightarrow N := \dim \mathcal{W}$.

Appendix B

Superoperators

Appendix B.1, p. 377, Eq. (B.6) $\hat{S}^x \rightarrow \hat{S}^\mu$.

Appendix B.2, below Exercise B.4

- “The following theorem confirms that any supermap ...” *to* “The following theorem confirms that any completely positive supermap ...”.
- “... find a more compact ...” \rightarrow “... find more compact ...”.

Appendix B.2, between Eqs. (B.30) and (B.31)

- $\{v_j\} \rightarrow \{|v_j\rangle\}$
- $|w_k\rangle \rightarrow \{|w_k\rangle\}$

Appendix B.4, p. 391, just below Eq. (B.53) “we have” \rightarrow “We have”.

Appendix B.4, p. 392, Eq. (B.56) $|\Psi\rangle\langle\Psi|$ should be replaced by $|\Phi\rangle\langle\Phi|$.

Appendix B.4, p. 393, the second last line “Whence, transposition ...” \rightarrow “Hence, transposition ...”.

Appendix C

Group Theory

Appendix C.1, p. 396, Definition C.1 (c) “... identity element $e \in \mathcal{G}$...” \rightarrow “... identity element $E \in \mathcal{G}$...”.

Appendix C.2, p. 399, Theorem C.8 (b) “... \mathcal{G} an be ...” \rightarrow “... \mathcal{G} can be ...”.

Appendix C.4, pp. 402, Defintion C.17 (a) “... $\mathcal{G} \otimes \mathcal{G}'$...” \rightarrow “... $\mathcal{G} \times \mathcal{G}'$...”.

Appendix C.4, pp. 403, Eq. (C.22) $\mathcal{G} \otimes \mathcal{G}' := \cdots \rightarrow \mathcal{G} \times \mathcal{G}' := \cdots$.

Appendix F

Solutions to Select Problems

Appendix F.3, p. 412 The heading “Quantum Computers” should be corrected to “Realizations of Quantum Comptuers” to match the original heading Chapter 3.

Appendix F.3, p. 412, Eq. (F.8) $|D\rangle := \cdots \rightarrow |\Omega\rangle := \cdots$.

Appendix F.3, p. 412, above Eq. (F.13) “... the Abelina geometric ...” \rightarrow “... the Abelian geometric ...”.

Appendix F.3, p. 413, above Eq. (F.17) “... a finite-finite dimensional ...” \rightarrow “... a finite-dimensional ...”.

Appendix F.5, p. 415 The heading “Decoherence” should be corrected to “Quantum Decoherence” to match the original heading Chapter 5.

Problem 6.7, p. 422, the display equation between (F.58) and (F.59) \hat{W} must be replaced with \hat{P}''' , i.e.,

$$\cdots (\hat{Z} \otimes \hat{W}) \cdots \rightarrow \cdots (\hat{Z} \otimes \hat{P}''') \cdots$$