**Mahn-Soo Choi (Korea University)**

# Errata: A Quantum Computation Workbook

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# Contents

# 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

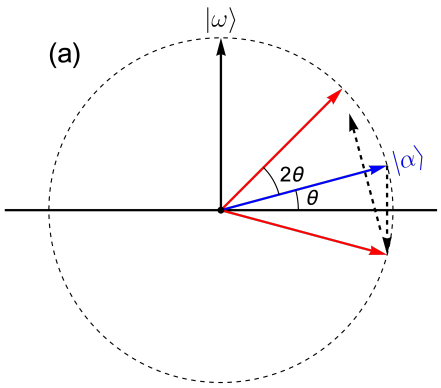
> What is the probability $p_0$ to find the *second* qubit in $|0\rangle$ (regardless of the *first* qubit)? Similarly, what is the probability $p_1$ to find the *second* qubit in the state $|1\rangle$?

# Chapter 4

# Quantum Algorithms

**Fig. 4.4b, p. 179** "... with respect to $\omega$ ..." $\rightarrow$ "... 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. 4.5**a**:




**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 (...), ..." –> "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 $\mathscr{F}_m(\hat{\rho})$" must reads as "...probabilities $\mathrm{Tr}\,[\mathscr{F}_m(\hat{\rho})]$".

**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

$$\frac{d\hat{\rho}}{dt} = \cdots \,.$$

**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

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

**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)**

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

must be changed to

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

**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 $\pm 1$" $\rightarrow$ "... 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)** $\hat{S}^x \to \hat{S}^\mu$.

**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 ..." → "... find more compact ...".

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

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

**Appendix B.4, p. 391, just below Eq. (B.53)** "we have" → "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 ..." → "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

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

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