Errata for Schumacher and Westmoreland's Quantum Processes, Systems, and Information

compiled by Scott N. Walck

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I have been unable to find an official list of errata for Benjamin Schumacher and Michael Westmoreland's lovely book, *Quantum Processes, Systems, and Information* (Cambridge University Press, 2010), ISBN 978-0-521-87534-9. If a reader of these errata knows of such an official list, please contact me. If a reader of the book knows of additional errors, please send them to me for inclusion in this list.

- p. 30, Fig. 2.10 caption: "stream of atoms moving from" should be "stream of atoms moving to"
- p. 32, Eq. 2.41: $|x+\rangle$ should be $|x_+\rangle$ (+ should be a subscript)
- p. 67, Exercise 3.40: $\mathsf{K} = -\frac{1}{2}(\mathsf{G} - \mathsf{G}^\dagger)$ should be $\mathsf{K} = -\frac{1}{2}i(\mathsf{G} - \mathsf{G}^\dagger)$ (equation is missing the i)
- p. 68, Eq. 3.88: $\mathsf{N}^\dagger\mathsf{N}$ should be $\mathsf{N}\mathsf{N}^\dagger$
- p. 68, Eq. 3.89: $\mathsf{N}\mathsf{N}^\dagger$ should be $\mathsf{N}^\dagger\mathsf{N}$
- p. 69, after Eq. 3.91: "operator $(\mathsf{A} - \alpha\mathbf{1})\,|\psi\rangle$" should be "operator $(\mathsf{A} - \alpha\mathbf{1})$"
- p. 87, after Eq. 4.21: $P(U) = \langle\psi|\,\Pi_u\,|\psi\rangle$ should be $P(u) = \langle\psi|\,\Pi_u\,|\psi\rangle$
- p. 102, Exercise 5.5: "The $|z_\pm\rangle$ eigenstates were stationary states with frequencies $\pm\Omega/2$." should be "The $|z_\pm\rangle$ eigenstates were stationary states with frequencies $\mp\Omega/2$."

- (Reported by Nate Gibbons, Justin Cammarota, and Andrew Wuerz on 2016 April 11) p. 130, sentence that contains Eq. 6.51: "then the conditional states of Bob's system B will be" should be "then the unnormalized conditional states of Bob's system B will be"
- p. 151, second bullet point: "sharing entanglement (Eq. 7.18)" should be "sharing entanglement (Eq. 7.19)"
- p. 171, footnote 3: "15-dimensional space" should be "8-dimensional space"
- p. 177, Eq. 8.69: Index k should be n so that the equation reads

$$\boldsymbol{\rho}^{(Q)} = \frac{\Omega^{(R)}(E)}{\Omega^{(QR)}(E)} \sum_n e^{-E_n/k_{\mathrm{B}}T} \left|n\right\rangle \left\langle n\right|$$

- p. 187, Eq. 9.18: $\mathsf{V}\left|\psi\right\rangle$ should be $\mathsf{V}\left|\phi\right\rangle$
- p. 187, Eq. 9.20: $\left|\phi\right\rangle$ should be $\left|\phi'\right\rangle$
- p. 202, The sentence at the bottom is cut off.
- p. 208, after Eq. 10.31: "If we start with vector $|x\rangle$" should be "If we start with vector $|\psi\rangle$".
- p. 208, Eq. 10.32: dx should be dx' in two places
- (Reported by Shane Jacobeen on 2014 Sep 27) p. 226, Eq. 11.13: The $\hbar$ on the right side of the first equation should be squared.
- p. 231, Eq. 11.39: The mass labelled m should be labelled μ.
- p. 232, Eq. 11.43: i should be replaced by $-i$ so that equation reads

$$\mathsf{xp} + \mathsf{px} = -i\hbar\mathbf{1} + 2\mathsf{xp}$$

- p. 232, Eq. 11.44: first i in second line should be $-i$; first i in third line should be $-i$
- p. 234, Eq. 11.55: A minus sign is missing in the exponent. Equation should read

$$\bar{\psi}_n = \left\langle p_n\right| \left.\psi\right\rangle = \frac{1}{\sqrt{L}} \int_0^L e^{-i2\pi nx/L} \psi(x)\, dx$$

- p. 239, Eq. 11.68: The 2 in the numerator should be in the denominator so that the equation reads

$$E_{n_x n_y} = \frac{\pi^2 \hbar^2}{2\mu} \left(\frac{n_x^2}{L_x^2} + \frac{n_y^2}{L_y^2} \right)$$

- p. 240, Eq. 11.76: The mass labelled m should be labelled μ.

- p. 242, Eq. 11.83: 2^ν should be $2^{2\nu}$ so that the equation reads

$$J_m(\rho) = \frac{\rho^m}{2^m} \sum_{\nu=0}^{\infty} \frac{(-1)^\nu}{2^{2\nu} \nu! (\nu + m)!} \rho^{2\nu}$$

- p. 249, after Eq. 12.8: $\mathsf{S}_z\mathsf{S}_- = \mathsf{S}_-\mathsf{S}_z - \hbar\mathsf{S}_+$ should be $\mathsf{S}_z\mathsf{S}_- = \mathsf{S}_-\mathsf{S}_z - \hbar\mathsf{S}_-$

- p. 251, Fig. 12.1: In the right-hand column labelling the m values, $s + 1$ should read $s - 1$.

- p. 251, Fig. 12.1 caption: The letter ϕ should not appear.

- p. 251, Eq. 12.13: $\geq$ should be $\leq$

- p. 252, line after Exercise 12.10: $d_m = d_m$ should be $d_m = d_{m'}$

- p. 255, Eq. 12.26: $\frac{\partial \phi}{\partial \theta}$ should be $\frac{\partial \psi}{\partial \theta}$

- p. 263, Fig. 12.3: At the bottom of the left column, $\frac{1}{2}$ should be $\frac{3}{2}$. At the bottom of the right column, $\frac{3}{2}$ should be $\frac{1}{2}$.

- p. 267, Problem 12.4: "Clebsch-Gordon coefficients $\langle s_1, m_1; s_2, m_2 \rangle s, m$ with" should be "Clebsch-Gordon coefficients $\langle s_1, m_1; s_2, m_2 | s, m \rangle$ with"

- p. 275, Equation above Eq. 13.32: An extra $\langle n|$ should not be there. The equation should read as follows.

$$\begin{aligned} \left\langle x^2 \right\rangle &= \frac{\alpha^2}{2} \langle n | \left(\mathsf{a}\mathsf{a}^\dagger + \mathsf{a}^\dagger \mathsf{a} \right) | n \rangle \\ &= \frac{\alpha^2}{2} \left(n \langle n | \, n \rangle + (n+1) \langle n | \, n \rangle \right) \end{aligned}$$

- p.275, Eq. 13.33: An extra 2 should not appear in the denominator of the last term. The equation should read as follows.

$$\Delta x = \sqrt{\frac{(2n+1)\alpha^2}{2}} = \sqrt{\left(n+\frac{1}{2}\right)\frac{\hbar}{\mu\omega}}$$

- (Reported by Shane Jacobeen on 2014 March 25) p. 283, Eq. 14.8: Equation should read as follows.

$$\mathsf{H} = \frac{1}{2\mu_1}\mathsf{p}_1^2 + \frac{1}{2\mu_2}\mathsf{p}_2^2 + U(\mathsf{x}_1, \mathsf{x}_2)$$

- (Reported by Daniel Brown on 2014 March 26) p. 286, Eq. 14.20: Small 1s should be *i*s so that equations read

$$[\mathsf{X}, \mathsf{P}] = i\hbar\mathbf{1} \qquad\qquad [\mathsf{x}, \mathsf{p}] = i\hbar\mathbf{1}$$

- (Reported by Anthony Hoover on 2014 April 7) p. 296, Eq. 14.51: Equation should read

$$\left\langle s^2 \right\rangle_{\pm} = \left\langle s^2 \right\rangle_{\text{dist}} \mp 2\left|x_{ab}\right|^2$$

- p. 299, Exercise 14.40: Part (c) should read "$\dim \mathcal{H}_2 = d_2$" rather than "$\dim \mathcal{H}_1 = d_2$".

- p. 317, Eq. 15.24: $Ce^{-ik'x}$ should be $Ce^{ik'x}$.

- (Reported by Anthony Hoover on 2014 April 28) p. 330, Eq. above 15.76: Equation should read

$$\frac{dE_n^{(\text{osc})}}{d\mu} = \langle n| \left(\frac{d\mathsf{H}}{d\mu}\right) |n\rangle$$

- p. 330, Eq. 15.76: Equation should read

$$-\frac{(n+1/2)\hbar}{2\mu}\sqrt{\frac{k}{\mu}} = -\frac{1}{2\mu^2}\langle n|\,\mathsf{p}^2\,|n\rangle$$

- p. 341, Fig. 16.2 caption: $N = 2n+1$ should be $N = 2n+l$

- p. 350, Eq. 17.6: The term
$$\lambda c_{kn}^{(1)},$$
which appears twice in the equation, should be replaced by
$$\lambda \sum_{k \neq n} c_{kn}^{(1)} \, |k\rangle$$
in both occurrences.

- p. 356, Eq. 17.35: $\omega_{ni} t$ should be $\omega_{ni} t/2$ inside the sine function.

- p. 356, Eq. 17.36: $\omega_{ni} t$ should be $\omega_{ni} t/2$ inside the sine function.

- (Reported by Justin Cammarota on 2017 April 25) p. 359, Eq. 17.45: $(2\pi)^2$ should be $(2\pi)^3$

- p. 361, Eq. 17.51: $e^{i\vec{q}\cdot\vec{r}}$ should be $e^{i\vec{q}\cdot\vec{r}/\hbar}$.

- p. 361, Eq. 17.52: $e^{i\vec{q}\cdot\vec{r}}$ should be $e^{i\vec{q}\cdot\vec{r}/\hbar}$.

- p. 362, Eq. 17.53: $e^{i\vec{q}\cdot\vec{r}}$ should be $e^{i\vec{q}\cdot\vec{r}/\hbar}$.

- p. 447, before Eqs. B.17: Integration should be over k not x. Equation should read
$$f(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} g(k) e^{ikx} \, dk.$$

- p. 447, Eqs. B.17: Integration should be over x not k. Equations should read
$$\begin{aligned} \tilde{f}(k) &= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} f(x) e^{-ikx} \, dx \\ &= \frac{1}{2\pi} \int_{-\infty}^{\infty} \left(\int_{-\infty}^{\infty} g(k') e^{ik'x} \, dk' \right) e^{-ikx} \, dx. \end{aligned}$$

- p. 447, Eqs. B.18: Integrations should be over k' not k.

- p. 448, Eqs. B.20: These three equations are each missing a factor of $1/\sqrt{2\pi}$ on the right-hand side. The equations should read as follows.

$$\begin{aligned}\tilde{h}(k) &= \frac{1}{\sqrt{2\pi}} \int_{-1}^{1} e^{-ikx}\, dx \\ &= \frac{1}{\sqrt{2\pi}} \frac{1}{-ik} \left(e^{-ik} - e^{ik}\right) \\ \tilde{h}(k) &= \sqrt{\frac{2}{\pi}} \frac{\sin k}{k}\end{aligned}$$

- p. 449, Eqs. B.23: These three equations are each missing a factor of $1/\sqrt{2\pi}$ on the right-hand side.

- (Reported by Andrea Lisowski on 2014 November 19) p. 452, Eqs. C.6: Integral is missing a dx.

- (Reported by Andrea Lisowski on 2014 November 19) p. 452, Eqs. C.7: Integral is missing a dx.