CORRECTIONS

to

Quantum computing

by Jozef Gruska, McGraw-Hill

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Please, be so kind and report misprints and errors found in "Quantum computing" to my email address "gruska@fi.muni.cz".

Corrections reported bellow, unless specified otherwise, are due to Marcos Curty Alonso, Holger Austinat, Charles Bennett, Marcus Bleicher, Jan Bouda, Ivana Bezáková, Dagmar Bruß, Tomaš Celetka, Murat Duran, Lenka Fibiková, Helmut Fink, Ian Glendinning, Lane Hemaspaandra, Ulrich Hertrampf, Wei-Han Huang, Katsunobu Imai, Chuzo Iwamoto, Philippe Jorrand, Dafa Li, Lev B. Levitin, Michal Marciniszyn, Luca Marinatto, Mehdi Mhalla, Kenichi Morita, Masanao Ozawa, Martin Pál, Kathrin Paschen, Martin Plenio, Melanie B. Shames, Stig Stenholm, Masa Toyama, Roland Vollmar, Thomas Worsch, Peter Žuffa, Wojciech H. Zurek, Thierry Zwissig and, especially, Miroslav Dudík.

PREFACE

page XVii, line +23 Replace "Volmar" by "Vollmar".

Chapter 1 — FUNDAMENTALS

page 17, line +13 Replace "matrix $\mathcal{M}$" by "matrix $M_{\mathcal{M}}$.

page 20, footnote 31 Replace "x^* denotes the conjugate of the complex number" by "For a complex number x, x^* denotes the conjugate of".

page 17, Exercise 1.3.3 Delete "of the same dimension".

page 20, footnote 32, line +2 Replace "numbers" by "integers" and "(nonnegative)" by "nonnegative".

page 21, footnote 36, line +2 Replace "$\langle c_1\phi_1 + c_2\phi_2, \psi\rangle$" by "$\langle c_1\phi_1 + c_2\phi_2|\psi\rangle$".

page 22, line -9 Replace "state" by "state ψ".

page 22, line -5 Replace "conjuction" by "conjugation".

page 22, line -3 Replace "each" by "each of".

page 23, line +5 Replace "any two of its elements" by "all its elements are mutually".

page 23, Exercise 1.4.10, line +2 Replace "$\leq$" by "$=$".

page 23, line +16 Replace "vector v" by "vector ψ"

page 24, line +3 Replace "$\langle\phi|\psi\rangle$" by "$\langle\psi|\phi\rangle$".

page 24, line +6 Replace twice "θ_i" by "ϕ_i"

page 24, line -1 Replace "$\langle\theta_i A|$" by "$\langle\theta_i|A$".

page 25, line -13 Replace "$\langle\phi, T^*, \psi\rangle$" by "$\langle\psi|T|\phi\rangle^*$.

page 26, line +2 Replace "matrix" by "positive matrix".

page 26, line -22 Replace "positve" by "positive".

page 27, line +19 Replace "are" by "are linear combinations of the".

page 28, line -1 Replace "$|\psi_i\rangle|\phi_i\rangle$" by "$|\phi_i\rangle|\psi_i\rangle$".

page 29, line -8 Replace "p^*_{ij}" by "p^*_{ji}".

page 29, line -4 Replace "$\lg\rho$" by "$\lg\rho$ (provided all eigenvalues of ρ are non-zero)".

page 32, line -1 Replace "Figure 1.6" by "Figure 1.6c".

page 32, footnote Replace "Bush" by "Busch".

page 35, line +2 Replace "Second," by "Second".

page 35, line -8 Replace "its"by "it".

page 37, line +5 Replace "see" by "sees".

page 37, line -3 Replace "result" by "results".

page 37, footnote, line +1 Replace "sees" by "seen".

page 39, line +21 Replace "Bush" by "Busch".

page 40, footnote 55, line +2 Replace "real" by "complex".

page 41, line +9 Replace "$\langle i, j\rangle$" by "$\langle i|j\rangle$".

page 45, line +9 Replace "Bush" by "Busch".

page 45, line +28 Replace "to$X$" by "to X".

page 46, line +11 Replace "constant" by "constant divided by 2π".

page 46, line +19 Replace "$e^{-Ht/\hbar}$" by "$e^{-iHt/\hbar}$".

page 49, line +17 Replace "bit" by "completely unknown bit".

page 54, line +13 Replace "$t^{\lg 4k}(n)$" by "$t^{\lg_k 4k}(n)$".

page 55, line +5 Replace "Toffoli" by "Fredkin".

page 55, Caption to Figure 1.21 Replace "Toffoli" by "Fredkin".

Chapter 2 — ELEMENTS

page 60, Fig. 2.2a Symbol "P" should be placed next to the black circle.

page 62, footnote Replace in the second matrix "ω" by "Ω".

page 65, Fig. 2.5g Entering photon should be marked by a filled circle.

page 66, Exercise 2.1.23, line -2 Replace, four times, "ϕ" by "ψ".

page 67, Exercise 2.1.25 Replace "**1**" by "**I**".

page 69, Footnote 15, line +2 Replace "orthgonal" by "orthogonal".

page 71, line +11 Replace "m qubits" by "n qubits".

page 76, line +12 Replace "GHZ state" by "GHZ pseudo-pure state".

page 76, Example 2.2.6, line +4 Replace "state the" by "the state".

page 77, line -1 Replace "states" by "and three-qubit states".

page 78, line +3 Replace "H_2" by "$H_2 \otimes H_2$".

paage[78, line +4 Replace "H_n" by "$H_n \otimes H_n$".

page 78, Remark 2.2.7, line -2 Replace "reach" by "rich".

page 79, line -3 Replace "is even" by "contains even number of 1's".

page 79, line -1 Replace in formula "$f_k(x_1, \ldots, x_n)$" by "$f_k(x_1, \ldots, x_k)$".

page 80, line +4 Replace "$f(x_1, \ldots, x_n)$" by "$f_k(x_1, \ldots, x_k)$".

page 80, line -6 Replace "$0 < \delta$" by "$0 \leq \delta$".

page 83, Exercise 2.3.7 Replace "Let a" by "Let A".

page 84, line +1 Replace "realizes" by "realize".

page 86, Exercise 2.3.21 Replace "Hadamard" by "rotation" and "six" by "eight".

page 87, line -5 Replace "sum of amplitudes" by "square root of the sum of the squares of".

page 88, line -14 Replace "transformation" by "transformations".

page 95, Exercise 2.3.38 Replace "one Toffoli gate" by "two Toffoli gates".

page 96, Figure 2.22 (a) Replace "$+d_i$" by "$\oplus d_i$".

page 96, Figure 2.23 (b) Replace "$2^n - (b-a)$" by "$2^n + (b-a)$".

page 98, line +11 Replace "$\leq$" by "$=$".

page 98, Figure 2.25b Exchange states $|\phi\rangle$ and $|\psi\rangle$.

page 99, line +14 Replace "$\langle j|(Q \circ |i\rangle\langle j|)_A|j\rangle$" by "$\langle j|(Q \circ |i\rangle\langle i|)_A|j\rangle$".

page 99, line +18 Replace second "$\mathcal{L}(H_{2^n})$" by "$\mathcal{L}(H_{2^m})$" and "(n,m)" by "$(n,m), n \leq m$,".

page 99, line +19 Replace "matrix" by "matrix ρ".

page 99, line +22 Replace "n qubits" by "m qubits".

page 99, line +24 Replace "H_{2^m}" by "H_{2^n}".

page 99, line +27 Replace ". This" by "for $x \in \{0,1\}^n$. This".

Chapter 3 — ALGORITHMS

page 104, line +12 Replace "$w_f = H_n$" by "$|w_f\rangle = H_n \frac{1}{\sqrt{2^n}}$".

page 104, line -11 Replace "$V_{F_k}|\psi_k\rangle =$" by "$V_{F_k}|\psi_k\rangle = \frac{1}{\sqrt{M_k}}$".

page 104, line -8 Replace "$|\langle\omega_f|\psi_k''\rangle|$" by "$|\langle\omega_f|\psi_k''\rangle|^2$".

page 105, Fig. 3.1a Extend the bottom line to fill the gap.

page 108, lines +9 and +11 Remove "first".

page 109, line +9 Replace "evaluating f" by "evaluating f_a".

page 110, line +13 Replace "$\alpha(x,y)$" by "$|\alpha(x,y)|$".

page 110, line +14 Replace "n independent" by "$n-1$ independent".

page 111, line +15 Replace "$f(x^{1)})$" by "$f(x^{(1)})$".

page 112, line +27 Replace "steps" by " steps (or $\mathcal{O}(\lg^3 n)$ of bit operations)".

page 114, Exercise 3.2.13, line +1 Replace "$\equiv$" by "$=$".

page 116, line -2 Replace "ξ_n" by "ξ".

page 117, line -10 Remove dot.

page 118, Figure 3.3 Add small black circle on the crossing of the horizontal line from $|a_{n-1}\rangle$ and the vertical line from the box for X_{n-1}".

page 118, Exercise 3.2.17 Replace "quantum" by "quantum circuit".

page 119, line +8 Replace, twice "$\ln m$" by "m".

page 119, line -4 Replace "$q \in \mathcal{O}(n^2)$" by "an integer q such that $n^2 \leq q = 2^l \leq 2n^2$".

page 119, Footnote 6, line -2 Replace "c;" by "c :".

page 121, line -8 Replace "$e^{2\pi ilc/q}$" by $e^{2\pi ilj/r}$".

page 121, line -7 Replace "$e^{2\pi ilc/q}$" by $e^{2\pi ilj/r}$".

page 121, line -5 Replace "$r-1$" by "$, r-1$".

page 123, Figure 3.5 In Figure (d) replace period "q/r" by "q". In caption add "In Figure (a) the initial state is depicted; in Figure (b) amplitudes of all basis states $|a\rangle$ is shown; in Figure (c) one see depicted a general function with offset l and period r. In discrete form this is depicted in Figure (d); in figure (e) the outcome after Fourier transform is shown.

page 124, line -5 Replace “probability” by “probability, for a fixed c and d,”.

page 124, line -4 Remove “the state”.

page 125, line +2 Replace “(mod$p$))” by “(mod$p$)”.

page 125, line +3 Replace “$\sum_{a,b,c,d}^{p-2}$” by “$\sum_{a,b}^{p-2}$” and “$a-rb=k$” by “$a-rb \equiv k(\bmod p-1)$”.

page 125, line +4 Replace “$a=k+rb$” by “$a=k+rb+s(p-1)$ for some s”.

page 125, line +5 Replace $\sum_{a,b,c,d}^{p-2}$” by “$\sum_{a,b}^{p-2}$”.

page 125, line +11 Replace “provide” by “provide a (random) $d<p-1$ and”.

page 125, line +12 Replace “rc” by “$-rc$”.

page 126, line +10 Replace “.}” by “}.”.

page 127, line +8 Replace “,^{12},^{13}, ^{14}” by “.^{12,13,14}”.

page 128, line -9 Replace “$\sqrt{n}$” by “$\sqrt{2^n}$”.

page 131, Exercise 3.3.5 Replace “If” by “Show that if”.

page 131, Exercise 3.3.6 Replace “(3)” by “(c)”.

page 131, line -17 Replace “U” by “U”.

page 132, line +2 Replace “th angle” by “the angle”.

page 133, line -4 Replace “$[1,\ldots,m]$” by “$\{1,\ldots,m\}$”.

page 133, footnote Replace “{” by “[”.

page 135, line +3 Replace “interupt” by “interrupt”.

page 135, line +4 Replace “$\frac{1}{\sqrt{m}}\sum_{i=1}^{m}$” by “$\frac{1}{\sqrt{n}}\sum_{i=1}^{n}$”.

page 135, line +12 Replace “$p(M,t)$” by “$Pr(M,t)$”.

page 135, line -9 Replace “Phase 2a” by “Step 2a”.

page 135, line -7 Replace “$\ln nlgn$” by “$\ln n \lg n$”.

page 136, line -4 Replace “that f” by “that F”.

page 137, line +5 Replace “A_0” by “X_0’ and “A_1” by “X_1”.

page 137, line +8 Replace “A_0” by “X_0’ and “A_1” by “X_1”.

page 138, line +9 Replace “neeeds” by “needs”.

page 140, Exercise 3.4.7 Replace “3.32 and 3.33” by “(3.32) and (3.33)”.

page 141, line -14 Replace “Stirling’ approximation” by “Stirling’s approximation”.

page 142, line +2 Replace “Ony” by “Only”.

page 146, lines +4, +5 "Replace last sentence in parentheses by X can be seen as an oracle function g such that $g(i) = x_i$ and f as a property of g; for example whether there is an i such that $g(i) = 1$."

page 149, line +7 Replace "shortest" by "longest".

page 149, line -9 Replace "network" by "quantum network".

page 149, line -7 Replace "duet" by "due".

page 149, line -2 Replace "$(D(f) = \mathcal{O}(f)^2)$" by "$(D(f) = \mathcal{O}(Q(f)^2))$".

Chapter 4 — AUTOMATA

page 152, line +4 Replace "400" by "380".

page 156, line +8 Replace "$|q_2 >$" by "$|q_2\rangle$".

page 156, line +16 Replace "global states" by "total states".

page 157, line -12 Replace "$[\phi\rangle \in [y']$" by "$|\phi\rangle \in [y']$".

page 157, line -7 Replace the first occurence of "$||^2$" by "$)||^2$".

page 158, line +8 Replace second "$x \in L$" by "$x \notin L$".

page 158, line -11 Replace "M0-1QFA" by "MO-1QFA".

page 159, line -6 Replace "$V_1'^k$" by "$V_1'^{k-j}$".

page 160, line +1 Replace "A," by "A, such that $||A|| \leq 1$, and"

page 162 Separability conditions I and II should be merged into one condition

$$\sum_{q'} \delta^*(q_1, \sigma_1, q', \rightarrow)\delta(q_2, \sigma_2, q', \downarrow) + \delta^*(q_1, \sigma_1 .q', \downarrow)\delta(q_2, \sigma_2, q', \leftarrow) = 0.$$

page 162, Lema 4.1.16 and its proof Replace "(4)" by "(3)".

page 163, line +14 Delete "$\sigma \in \Gamma$,".

page 166, lines -11 and -10 Replace "Phase 3 ... probability $1 - \frac{1}{n}$." by "Phase 3, when any (sigle) computation path arrives at the left endmarker and measuremnt is performed, then acceptance is with probability $\frac{1}{n^2}$ and rejection with probability $\frac{n-1}{n^2}$. Total acceptance probability is therefore $n\frac{1}{n^2} = \frac{1}{n}$."

page 168, line -2 Replace "tape" by "finite control".

page 170, line +14 Replace "any" by "any two different triples".

page 171, line +17 Replace "condition 3" by "condition 2".

page 172, line +10 Replace "α_{ij} " by "α_{1j}".

page 173, line +3 Replace "satisfies" by "satisfy".

page 174, lines +12 and +13 Replace "the first condition of Remark 4.2.1" by "Separability condition II' from page 173".

page 177, line -10 Replace "$(1+\delta)^t \leq e$" by "$\delta(1+\delta)^t \leq \delta e$".

page 179, Exercises 4.2.33, 4.2.34 Replace "well-formed" by "well-behaved".

page 180, line +1 Replace "normal-form" by "normal-form and well-behaved".

page 180, lines +8 and +12 Replace "well-formd" by "well-behaved".

page 184, line -12 Replace ". The amplitude of such a transition, $\alpha(c_1, c_2)$, is" by "with the amplitude $\alpha(c_1, c_2)$ ".

page 184, line -9 Delete "therefore".

page 185, line +6 Replace "finte configurations" by "finite configurations (that is such configurations c that $c(i) \neq \lambda$ only for finitely many i),".

page 185, line -9 Replace "$|\phi$" by "$|\phi\rangle$".

page 186, line +17 Replace "to" by "to the precision".

page 186, line -2 Replace "partitioned" by "partitioned quantum".

page 187, Figure 4.6 An arrow from the right (left) subcell of a cell should lead to the right (left) subcell of the right (left) neigbouring cell.

page 187, line -15 Replace "$(q_{1,1}, q_{2,2}, \ldots, q_{r,r})$" by "$(q_{r,1} . q_{r-1,2}, \ldots, q_{1,r})$".

page 187, line -14 Replace "one-way" by "one-dimensional".

page 187, line -11 Replace "operator" by "operator is determined by the mapping".

page 187, line -8 Delete "evolution".

page 187, line -2 Replace "1CA" by "1QCA".

page 188, line +13 Replace "$-\frac{1}{\sqrt{2}}$" by "$\frac{1}{\sqrt{2}}$"

page 189, line +14 Replace "$H' =$" by "$H' = \frac{1}{\sqrt{2}}$".

page 191, line -19, -20 Exchange "leftmost" and "rightmost".

page 191, lines -17, -3, -2, -1 Replace "(q'_l, q'_m, q'_r)" by "(p_l, p_m, p_r)".

page 191, line -13 Replace "$\rightarrow$" by "$\leftarrow$".

page 191, line -9 Replace "$\leftarrow$" by "$\rightarrow$".

page 191, line -12 Replace second "q_l" by "l".

page 191, lines -1, -2, and -3 Exchange arguments of the function U.

page 192, line +12 Replace "(λ, c, λ)" by "$(\lambda_l, c, \lambda_l)$".

page 192, line +14 Replace "a^*" by "a'".

page 194, lines -19 and -21 Replace "U" by "$\mathcal{U}$".

Chapter 5 — COMPLEXITY

page 195, line -9 Replace "$\sum_{j=1}^{n}|v_j|^2$" by "$\sum_{i=j}^{n}|v_i|^2$".

page 195, line -3 Replace "$|R_j - R'_j|$" by "$||R_j - R'_j||$".

page 197, line +5 Replace "$10\sqrt{d} \leq 2$" by "$10\sqrt{d} \geq 2$".

page 198, end of Section 5.1.1 Insert "*qed*" at the end of the proof of Theeorem 5.1.1.

page 200, line -2 Replace "variance" by "variation".

page 203, line -19 Replace "PTM" by "DTM".

page 204, line +14 Replace "in all cells of" by "in all cells except those of".

page 205, line 10 Remove sentence starting with "Since". (See also Additions, a comment to page 205.)

page 205, line -8 Replace "that" by "that, for space-constructible functions $s(n) = \Omega(\lg n)$," "QTM" by "QTM with rational transition amplitudes" and "PTM" by "PTM with rational transition amplitudes".

page 205, footnote 7 To be more precise, Wagner introduced the notation $\mathbf{C_{=}P}$, but the class itself was introduced by Jonas Simon, in his PhD Thesis, where he also proved $\mathbf{C_{=}P} \subseteq \mathbf{PP}$.

page 206, line -11 Replace "QNC" and "NC" by "**QNC**" and "**NC**".

page 207, line +18 Replace "$|Ux\rangle$" by "$U|x\rangle$".

page 208, line +14 Replace "M_i" by "$\mathcal{M}_i$".

page 208, lines +19 - +20 Replace "By the definition of A_n, the set A_n" by "By the definition of R_n, the set R_n".

page 208, line +28 Replace "length $2^{p(n)}$ or less" by "length less than $2^{p(n)}$".

page 208, line +31 Replace "$Y_B \in \{1\}^*$" by "$Y_B \subseteq \{1\}^*$".

page 208, line +32 Replace "$Y_B \subseteq \mathbf{EQP}^B$" by "$Y_B \notin \mathbf{EQP}^B$".

page 209, line +20 Replace "exists"by "exist".

page 213, line -20 Replace "then" by "than".

page 213, line -13 Replace "(if possible)," by "(if possible).".

page 213, line -10 Replace "D" by "$\mathcal{D}$".

page 213, line -5 Replace "nad" by "and".

Chapter 6 — CRYPTOGRAPHY

page 223, line +7 Replace "reset" by "resent".

page 223, line +8 Replace "using" by "by first bringing each signal to a contact with an ancilla and then using".

page 224, line +11 Replace "of S" by "of s".

page 224, footnote Replace "$|O\rangle$" by "$|0\rangle$".

page 226, Exercise 6.2.2 Replace "$0'\rangle$ by "$|0'\rangle$" and "$1\rangle$" by "$|1\rangle$".

page 227, line -10 Delete "the number of".

page 227, footnote, line -2 Replace "$e^{-\frac{n\varepsilon^2}{2n}}$" by "$e^{-\frac{n\varepsilon^2}{2p}}$".

page 231, line +22 Remove "labelekert1".

page 236, line +22 Replace "bit error" by "(quantum) bit error rate (BER or QBER — the ratio of errors to detected events)".

page 236, line -1 Replace 'BB92" by "B92".

page 238, line -2 Replace "reveal x" by "reveal b".

page 246, line +3 Replace "$\frac{3}{4}$" in the second row of the first matrix by '$\frac{1}{4}$" and "$\frac{1}{4}$" in the second row of the second matrix by "$\frac{3}{4}$".

page 246, line +12 Replace "$\langle\theta_1\rangle$" by "$|\theta_1\rangle$".

page 251, line +16 Replace "from x and" by "from y and".

page 251, footnote, line +5 Replace "deferring" by "defying".

page 251, footnote, line -2 Replace "defers" by "defies".

page 253, lines -5 and -6 Formula should have the form:

$$\begin{aligned} |\phi\rangle &= |\Phi^+\rangle\frac{1}{2}(\alpha|0\rangle + \beta|1\rangle) + |\Psi^+\rangle\frac{1}{2}(\beta|0\rangle + \alpha|1\rangle) \\ &\quad +|\Phi^-\rangle\frac{1}{2}(\alpha|0\rangle - \beta|1\rangle) + |\Psi^-\rangle\frac{1}{2}(\beta|0\rangle - \alpha|1\rangle) \end{aligned}$$

page 253, line -1 Delete all "$\frac{1}{\sqrt{2}}$" and replace "$\beta|0\rangle + \alpha|1\rangle$" by "$\beta|0\rangle - \alpha|1\rangle$".

page 254, line +5 Replace "$|\phi\rangle$" by "$|\psi\rangle$".

page 256, line -1 Delete all "$\frac{1}{\sqrt{2}}$".

page 257, line -4 Replace "receives" by "wants to send to Bob" and "performs" by "performs first".

page 257, line -2 Replace "this state" by "her particle".

page 257, line -1 Replace "states" by "particles".

page 258, line +2 Replace "Alice" by " that uniquelly determine two bits Alice".

page 258, Figure 6.15, first row Replace "Alice's particle: new state" by "New state of particles" and "Bob's XOR transformation" by "State of particle after XOR transformation".

Chapter 7 — PROCESSORS

page 264, line -1 Replace "$+U^t(|1\rangle)$" by "$+\varepsilon U^t(|1\rangle)$".

page 270, line +18 Replace "$H^{(r)}$" by "H".

page 270, line -10 Replace $\psi_{\sigma_i(1)}$" by "$\phi_{\sigma_i(1)}$".

page 272, line +9 Replace "problem" by 'problems".

page 272, line -11 Delete one "codes".

page 274, line +5 Replace "$\lceil (n-1)/2 \rceil$" by "n".

page 274, line -3 Replace "of an" by "of a binary".

page 275, line +4 Replace "$-A^T$" by "A^T".

page 275, line +13 Replace "q^n" by "q^k".

page 275, line +14 Replace "$V(n,q)$" by "$V(k,q)$".

page 275, line -1 Replace "cosets" by "coset".

page 279, line +4 Replace "exists" by "exist".

page 279, line +19 Replace "types of error" by "types of errors".

page 280, line +7 Replace "changes" by "change".

page 280, line +10 Replace "disentangled" by "disentangle".

page 280, line -1 Replace ""error" and" by " "erroror") and".

page 281, line +12 Replace "Where" by ,,If".

page 281, line +17 Replace "ϕ_e" by "ϕ_E".

page 281, line -20 Remove one "processes".

page 281, line -13 Remove one "code".

page 282, line -19 Replace "to a get" by "to get".

page 284, Figure 7.2, line +6 Replace "$|0111100\rangle$" by "$+|0111100\rangle$".

page 285, line +9 Replace "case" by "cases".

page 285, line 6 Replace "Zurek (1996)" by "Zurek, 1996)".

page 286, Fig 7.3b Replace "$|\beta$" by "$|\beta|1\rangle$".

page 287, line +4 Replace "$|a_0\rangle$." by "$|a_0\rangle$," and "$b_1\rangle$" by "$|b_1\rangle$".

page 288, line +2 Replace "error symbols" by "error syndroms".

page 291, line +3 Replace "$\{0,1\}^k$" by "$\{0,1\}^n$".

page 292, line -1 Replace "E_1" by "$M = E_1$".

page 293, line +9 Replace "M" by "B".

page 293, line +16 Replace "herefore" by "C therefore".

page 293, Figure 7.8b In the column for M_4 replace last three X's by I's and exchange in the whole matrix the first and seventh column, the second and sixth column a well as the third and fifth column.

page 294, line +21 Replace "any" by "some" and "S" by "S_C".

page 294, line +23 Replace "non-degenerate code" by "non-degenerate code to correct t errors".

page 294, lines -18 -17 Replace "properties ... stabilizer." by "properties a set $\mathcal{S}' \subseteq \mathcal{G}_n$ should have to be a stabilizer of a code C."

page 294, lines -16, -15, -12, -10 Replace "$\mathcal{S}_C$" by "$\mathcal{S}'$".

page 294, line -16 Replace "is clearly" by "should clearly be".

page 294, line -14 Replace "have therefore" by "already know".

page 294, line -9 Replace "$\mathcal{S}_c$" by "$\mathcal{S}'$".

page 294, line -6 Replace "$\mathcal{E}_0$" by "$S_{\mathcal{E}}$".

page 294, line -1 Replace "length" by "weight".

page 298, line -16 Replace "codewe" by "code we".

page 298, line -1 Replace "$\sum_{i=0}^{7} |i\rangle$" by "$\sum_{i\in\{0,1\}^4}(1 - parity(i)|i\rangle$".

page 299, line +3 Replace "$|\phi\rangle$." by "$|\phi\rangle$.)"

page 299, line +4 Replace "copping" by "copying".

page 299, line +6 Replace "$|\psi\rangle$" by "$|\phi\rangle$".

page 299, Figure 7.11 Remove last two XOR-gates connecting Shor state with last two bits of additional ancilla and put two XOR-gates just before the collumn of H-gates. For the first XOR gate the first qubit of the cat state should be the control bit and the first qubit of the ancilla should be the target qubit. For second XOR-gate, again the first qubit of the cat state should be the control qubit and the second qubit of additional ancilla should be the target qubit. In addition, the multiple XOR-gate should be replaced by three XOR gates. The first [second] {third} XOR -gate has the first [second] {third} control bit on the first [second] {third} qubit and their target qubit is the second [third] {fourth} qubit of the first ancilla.

page 300, line +22 Remove one "in".

page 301, line +14 Replace "290" by "300".

page 305, line +5 Replace "with" by "work with".

Chapter 8 — INFORMATION

page 311, line -3 Replace "high" by "long".

page 315, line +7 Replace "nature" by "Nature".

page 318, line +27 Replace "ρ" by "X".

page 319, line +9 Replace "$\lambda_1 > \lambda_2$" by "$\lambda_1 \geq 0, \lambda_2$".

page 319, line +11 Replace twice "TR" by "Tr".

page 319, lines +13, +14 Replace "$|$" by "$||$".

page 319, line +19 Replace "with." by "with. A different, and more sound approach has been developed by L. B. Levitin in the paper *Conditional entropy amd information in quantum system: Chaos, Solitons, & fractals, V10, N 10, p 1651-1656.* His approach is based on a natural concept of conditional density matrix and leads to inequalities

$$QS(X|Y) \leq QS(X,Y) - QS(Y)$$

$$QI(X:Y) \leq QS(X) - QS(X|Y).$$

Equalities hold under reasonable conditions. For more details see in *updatings.ps* a remark added to page 320.

page 319, line -18 Replace "$\mathbf{I}_A$" by "$\mathbf{I}_X$".

page 320, line +11 Replace "XY" by "X, Y".

page 321, line +14 Replace "$[\phi\rangle$" by "$[\psi\rangle$".

page 323, line -5 Replace "variable X" by "variable Y".

page 324, Figure 8.3 Code for message 1010 should be 11000.

page 325, line +11 Replace "matrix" by "matrix ρ".

page 325, line -2 Replace all three "ψ" by "ϕ".

page 326, line +10 Replace "$\sum_{i=1}^{d}$" by "$\sum_{j=1}^{d}$".

page 327, line +5 Replace "α_i" by "ϕ_i".

page 327, line +13 Repkace "$QS(X)$" by "$QS(\rho)$".

page 327, line -19 Replace "vectors of X^k" by "eigenvalues of X".

page 327, line -16 Replace "$QS(X)$" by "$QS(\rho)$".

page 327, line -15 Replace "$QS(\rho_k)$" by "$QS(\rho)$".

page 327, line -5 Replace "its" by "a".

page 327, line -1 Replace "$aaaa$" by "aaa".

page 328, line +8 Replace first "$0.9 \cdot 0.1^2$" by "$0.9^2 \cdot 0.1$".

page 328, line +9 Replace "ρ" by "ρ_a", "0.18" by "0.028" and "8.2.10" by "8.2.11".

page 328, line +10 Replace "$0.964 = 1 - 2 \cdot 0.18$" by "$0.944 = 1 - 2 \cdot 0.028$".

page 328, line -6 Replace "H_n" by "H_{2^n}".

page 328, line -2 Replace "u_0 and u_1" by "$|u_0\rangle$ and $|u_1\rangle$".

page 328, line -1 Replace "$\frac{1}{2+\sqrt{2}}(|u_{x_1}\rangle + |u_{x_2}\rangle)$" by "$\frac{1}{2+(-1)^{x_1x_2}\sqrt{2}}(|u_{x_1}\rangle + (-1)^{x_1x_2}|u_{x_2}\rangle)$".

page 329, lines -9 and -8 Replace "$\bigoplus_{i=1}^n$" by "$\bigotimes_{i=1}^n$".

page 330, line +1 Replace "$n \overset{0.85}{\to} n$" by "$2n \overset{0.85}{\to} n$".

page 330, line -11 Formula should have the form:

$$QC_C(\mathcal{N}) = \lim_{\varepsilon \to 0} \limsup_{n \to \infty} \{\frac{n}{m} \mid \exists_{m,\mathcal{E},\mathcal{D}} \forall_{\psi \in H_{2^n}} (\langle \psi | \mathcal{D}\mathcal{N}^{\oplus m}\mathcal{E}(|\psi\rangle\langle\psi|)|\psi\rangle > 1 - \varepsilon\}.$$

page 331, line -6 Replace "$C(\theta)$" by $C(\mathcal{N})$".

page 332, line +6 Replace "easily," by "intact".

page 332, line -1 Replace "entangled" by "bipartite entangled".

page 333, line +3 Replace "bipartite states" by "reduced density matrices".

page 333, line +9 Replace "denotes" by "denote".

page 333, line +10 Replace "$\mathcal{H}_A$-state" by "density matrix".

page 333, lines -9 - -8 Replace "entangled qubits" by "particles in the EPR state".

page 336, line -19 Replace "$|\Psi_k\rangle$" by "$|\psi_k\rangle$".

page 338, line +17 Remove "holds:".

page 338, line +18 Replace "$E_r(\rho_1)E_r(\rho_2)$" by "$E_r(\rho_1) + E_r(\rho_2)$".

page 338, line +19 Replace "for" by "does not hold for".

page 339, line +12 Replace "$4 > \alpha \leq 5$" by "$4 < \alpha \leq 5$".

page 339, line -1 Replace "subsystems." by "subsystems"."

page 349, footnote Replace "Bush" by "Busch".

page 352, line +27 Replace "Bush" by "Busch".

Chapter 9 — APPENDIX

page 352, line -3 Replace "in a" by "in an".

page 354, line +5 Exchange "cools down" and "heats up".

page 354, footnote, line -1 Replace "Fex" by "Rex".

page 356, line -1 Replace "second" by "same".

page 357, line +2 Replace "a even" by "an even".

page 359, line +8 Replace "philosphers" by "philosophers".

page 368, Exercice 9.2.16 Replace "$\langle\phi|\psi\rangle$; by "$\langle\phi|\psi\rangle$; (b)".

page 371, line +14 Delete "real".

page 372, line +7 In formula for $[\psi_2\rangle$ replace "2" by "$2\sqrt{2}$".

page 373, line +20 Replace "subspaces." subspaces and P_{λ_i} is the projection operator to the subspace generated by eigenvectors of λ_i."

page 375, lines +8 - +9 Replace the text by "If the spectrum of A is simple, then the probability $prob_{\psi}(\lambda_i)$ that a measurement of the observable A conducted on the system in the state ψ yield λ_i as the classical outocome can be computed by the following ("statistical") algorithm."

page 375, line +17 Replace "define" by "determine".

page 375, line +18 Replace "$|\psi\rangle \in H$" by "a subspace W the probability $prob_{\rho}(W)$ that a measurement of the observable A conducted on the system in the state ρ results in a state in L as follows".

page 377, line +9 Replace "$\psi = \sum_{i=1}^{n} |\phi_i\rangle$" by "$|\psi\rangle = \sum_{i=1}^{n} c_i|\psi_i\rangle$".

page 377, line +10 Replace "$|\sum_{j=1}^{k} c_{i_j}|^2$" by "$\sum_{j=1}^{k} |c_{i_j}|^2$".

page 377, line +10 Replace twice "λ'_{i_j}" by "c_{i_j}".

page 378, line -1 Replace "Bush" by "Busch".

page 389, line +17 Replace "$\rightarrow$" by "$\Rightarrow$".

page 390, line +5 Replace "such that" by "such that (actually in the following any constant greater than $\frac{1}{2}$ could replace $\frac{3}{4}$)".

page 390, line -12 Replace "$\subseteq$" by "$\subsetneq$".

Chapter 9 — BIBLIOGRAPHIC REFERENCES

page 395, line +15 Replace "Fix" by "Rex".

page 399, line -10 Replace "1932" by "1927".

page 400, line +17 Replace "Bush" by "Busch".

BIBLIOGRAPHY

page 401 The following item is missing: "Daniel S. Abrams, Seth Lloyd: Simulation of many-body Fermi systems on a universal quantum computer, quant-ph/9703054".

page 402, item 21; page 406, item 128; page 407, item 146; page 408, item 173 Replace "Chiarra" by "Chiara".

page 403, item 57 Replace "Quantifying" by "Quantum".

page 404, item 66 Replace "retrospectives" by "retropsective".

page 403, item 59 Replace "entaglement" by "entanglement".

page 404, item 81 Replace "DeMartini, Franco" by "De Martini, Francesco".

page 405, item 92 Replace "Adanvecs" by "Advances"

page 406, item 109 Replace "Bush" by "Busch".

page 406, item 113 Replace "clonning" by "cloning".

page 407, item 133 Relplace "spectrocopy" by "spectroscopy".

page 409, item 193 Replace "Physival" by "Physical".

page 410, item 208 Replace "querry" by "query".

page 410, item 211 Replace "STOCS" by 'STOC".

page 410, item 212 Replace "serach" by "search".

page 411, item 242 Replace "consequances" by "consequences".

page 412, item 267 Replace "intenzity" by "intensity".

page 413, items 271-273 Replace "Ralf" by "Rolf".

page 413 The following item is missing: "Landauer Rolf: Irreversibility and heat generation in the computing process, IBM Journal of Research and Development, V3, 183-191, 1991".

page 413, item 277 Replace "Fex" by "Rex (Eds.)".

page 413, item 278 Add title: "On the quantum measure of the amount of information" and pages: 111-115.

page 413, item 279 Replace "15-" by "15-48".

page 414, item 296 Replace "K. Mattle" by "Klaus Mattle".

page 414, item 298 Replace "Unconditinaly" by "Unconditionaly".

page 414, item 299 Yao's name have been withdrawn in a newer version of the paper.

page 415, item 321 Replace "appriximate" by "approximate".

page 415, item 328 Replace "ü" by "u".

page 415, item 333 Replace "quanat" by "quant".

page 417, item 372 Replace "J. Brendel" by "Jörgen Brendel".

page 417, item 387 Replace "lementary" by "elementary".

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page 419 Replace "Abrams, D. S." by "Abrams, Daniel S.".

page 419 Replace "Ananden J." by "Anandan Jeeva S.".

page 421 Replace "Bose, Sugato" by "Bose, Sougato".

page 421 Replace "Brendel J." by "Brendel Jürgen".

page 421 Replace "Bush" by ,,Busch".

page 421 Replace "Buttler, W.T." by "Buttler, William, T.".

page 421 Replace "Caves, C. M." by "Caves, Cari M.".

page 421 Replace "Chau, H. F." by "Chau, Hoi Fung".

page 423 Replace "DeMartini, Franco" by "DeMartini Francesco"

page 423 Replace "Dieks D." by "Dieks Dennis".

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page 425 Replace "Fermi E." by "Fermi, Enrico".

page 426 Replace "Glauber J. R." by "Glauber Roy J.".

page 427 Replace "Jordan T. F." by "Jordan Thomas F.".

page 427 Replace "King B. E." by "King Brain E.".

page 427 Replace "Lamoreaux, S.K." by "Lamoreaux Steve K.".

page 427 Replace "Landauer, Ralf" by "Landauer, Rolf".

page 427 Replace "Lange W." by "Lange, Wolfgang".

page 428 Replace "Leibfried D." by "Leibfried Dietrich".

page 428 Replace "Macchiavello Chiarra" by "Macchiavello Chiara".

page 428 Replace "MacWilliams, F. J." by "MacWilliams, Florence J."

page 429 Replace "Nordholt, J. E." by "Nordholt Jane E.".

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page 436 Replace “Somaroo S. S.” by “Somaroo Shyamal S.”.

page 437 Replace “Tapster Piaul” by “Tapster Paul”.

page 439 Replace “Wunderlich, C” by “Wunderlich, Christof”.