

BAYESUVIUS QUANTICO

A VISUAL DICTIONARY OF
QUANTUM BAYESIAN NETWORKS



ROBERT R. TUCCI

Bayesuvious Quantico, a visual dictionary of Quantum Bayesian Networks

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This book is constantly being expanded and improved. To download
the latest version, go to

<https://github.com/rrtucci/bayes-quantico>

Bayes Quantico

by Robert R. Tucci

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Tensor and Diagrammatic Notation: COMING SOON

$$P(y) = \sum_x P(y|x)P(x) \quad (19.1)$$

$$\langle y|\psi\rangle = \sum_x \underbrace{\langle y|A|x\rangle}_{A(y|x)} \langle x|\psi\rangle \quad (19.2)$$

$$\longleftarrow = \overleftarrow{\sum_a} = \sum_a |a\rangle\langle a| \quad (19.3)$$

$$\langle a|q\rangle = \sum_b \langle a|G|b\rangle \langle b|q\rangle \quad (19.4)$$

$$q_a = \sum_b G_a^b q_b \quad (19.5)$$

$$\overleftarrow{q}_a = \overleftarrow{q}_a G \overleftarrow{q}_{\Sigma b} \quad (19.6)$$

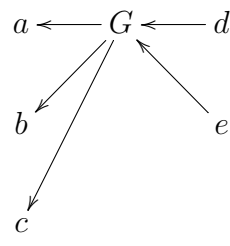
$$\langle q|a\rangle = \sum_b \langle b|G^\dagger|a\rangle \langle q|b\rangle \quad (19.7)$$

$$q^a = \sum_b (G^\dagger)_b^a q^b \quad (19.8)$$

$$q \overleftarrow{q}_a = q \overleftarrow{q}_{\sum b} G^\dagger \overleftarrow{q}_a \quad (19.9)$$

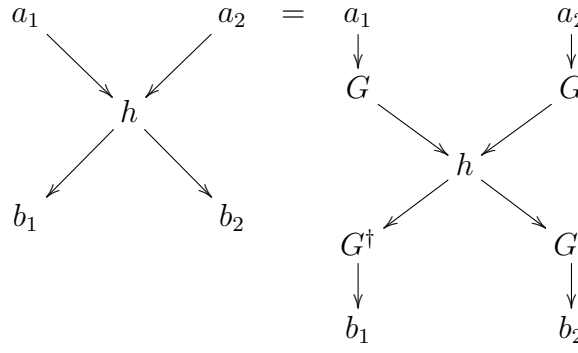
$$\overleftarrow{q}_a q = a \longleftarrow q \quad (19.10)$$

$$q \overleftarrow{q}_a = q \longleftarrow a \quad (19.11)$$

$$G_{a,b,c}^{d,e} = \langle a, b, c | G | d, e \rangle =$$


$$(19.12)$$

$$\langle b_1, b_2 | h | a_1, a_2 \rangle = \langle G^\dagger b_1, G^\dagger b_2 | h | G a_1, G a_2 \rangle \quad (19.13)$$

$$=$$


$$(19.14)$$

$$G_b^a = \delta_b^a + i \sum_j \epsilon_j (T_j)_b^a \quad (19.15)$$

$$\overleftarrow{G}_b \overleftarrow{a} = \overleftarrow{\delta}_b \overleftarrow{a} + i \sum_j \epsilon_j \overleftarrow{T_j}_b \overleftarrow{a} \quad (19.16)$$

Assume $T_j^\dagger = T_j$. To first order in ϵ_j ,

$$0 = i \sum_j \epsilon_j \left(\begin{array}{ccc} \begin{array}{c} a_1 \\ \downarrow \\ T_j \\ \searrow \\ h \end{array} & \begin{array}{c} a_2 \\ \downarrow \\ \delta \\ \swarrow \\ h \end{array} & \begin{array}{c} \delta \\ \downarrow \\ b_1 \end{array} \\ \begin{array}{c} \delta \\ \swarrow \\ h \end{array} & \begin{array}{c} \delta \\ \swarrow \\ h \end{array} & \begin{array}{c} \delta \\ \downarrow \\ b_2 \end{array} \end{array} + \begin{array}{ccc} \begin{array}{c} a_1 \\ \downarrow \\ \delta \\ \searrow \\ h \end{array} & \begin{array}{c} a_2 \\ \downarrow \\ T_j \\ \swarrow \\ h \end{array} & \begin{array}{c} \delta \\ \downarrow \\ b_1 \end{array} \\ \begin{array}{c} \delta \\ \swarrow \\ h \end{array} & \begin{array}{c} \delta \\ \swarrow \\ h \end{array} & \begin{array}{c} \delta \\ \downarrow \\ b_2 \end{array} \end{array} \right) \quad (19.17)$$

$$- i \sum_j \epsilon_j \left(\begin{array}{ccc} \begin{array}{c} a_1 \\ \downarrow \\ \delta \\ \searrow \\ h \end{array} & \begin{array}{c} a_2 \\ \downarrow \\ \delta \\ \swarrow \\ h \end{array} & \begin{array}{c} \delta \\ \downarrow \\ b_1 \end{array} \\ \begin{array}{c} T_j \\ \swarrow \\ h \end{array} & \begin{array}{c} \delta \\ \swarrow \\ h \end{array} & \begin{array}{c} \delta \\ \downarrow \\ b_2 \end{array} \end{array} + \begin{array}{ccc} \begin{array}{c} a_1 \\ \downarrow \\ \delta \\ \searrow \\ h \end{array} & \begin{array}{c} a_2 \\ \downarrow \\ \delta \\ \swarrow \\ h \end{array} & \begin{array}{c} \delta \\ \downarrow \\ b_1 \end{array} \\ \begin{array}{c} \delta \\ \swarrow \\ h \end{array} & \begin{array}{c} T_j \\ \swarrow \\ h \end{array} & \begin{array}{c} \delta \\ \downarrow \\ b_2 \end{array} \end{array} \right) \quad (19.18)$$

from which we get one equation for each ϵ_j .

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Unitary Groups: COMING SOON

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