

BAYESUVIUS QUANTICO

A VISUAL DICTIONARY OF
QUANTUM BAYESIAN NETWORKS



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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

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

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

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

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

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

$$\overleftarrow{a} q = \overleftarrow{a} G \overleftarrow{\sum_b} q \quad (19.6)$$

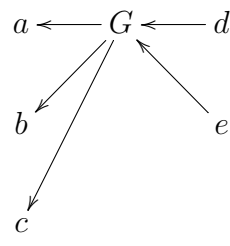
$$\langle q|a\rangle = \sum_b \langle b|G^\dagger|a\rangle \langle q|b\rangle \quad (19.7)$$

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

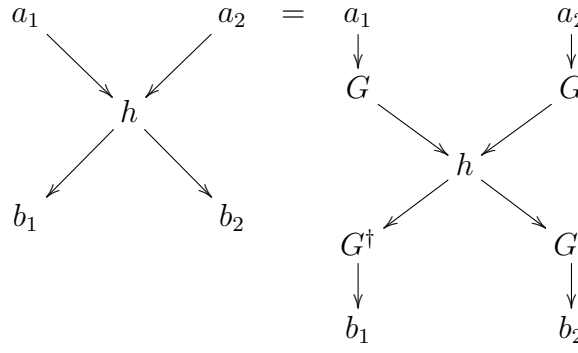
$$q \overleftarrow{a} = q \overleftarrow{\sum_b} G^\dagger \overleftarrow{a} \quad (19.9)$$

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

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

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

(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)

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

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

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

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

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

from which we get one equation for each ϵ_j .

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Unitary Groups

Chapter 21

Wigner Coefficients

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Wigner-Ekarts Theorem

Chapter 23

Young Tableau

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