

BAYESUVIUS QUANTICO

A VISUAL DICTIONARY OF
QUANTUM BAYESIAN NETWORKS



ROBERT R. TUCCI

Bayesuvious Quantico, a visual dictionary of Quantum Bayesian Networks

Robert R. Tucci
www.ar-tiste.xyz

July 15, 2025

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

Copyright ©2025, Robert R. Tucci.

This work is licensed under the Creative Commons Attribution-Noncommercial-No
Derivative Works 3.0 United States License. To view a copy of this license, visit the
link <https://creativecommons.org/licenses/by-nc-nd/3.0/> or send a letter to
Creative Commons, PO Box 1866, Mountain View, CA 94042.

Contents

1	Antisymmetrization	3
2	Clebsch-Gordan Coefficients	4
3	Invariants	5
4	Spectral Decomposition	6
5	$SU(n)$	7
6	Symmetrization	8
7	Tensor and Diagrammatic Notation	9
	Bibliography	12

Chapter 1

Antisymmetrization

Chapter 2

Clebsch-Gordan Coefficients

Chapter 3

Invariants

Chapter 4

Spectral Decomposition

Chapter 5

$SU(n)$

Chapter 6

Symmetrization

Chapter 7

Tensor and Diagrammatic Notation

$$P(y) = \sum_x P(y|x)P(x) \quad (7.1)$$

$$\langle y|\psi\rangle = \sum_x \underbrace{\langle y|A|x\rangle}_{A(y|x)} \langle x|\psi\rangle \quad (7.2)$$

$$\longleftarrow = \overleftarrow{\sum a} = \sum_a |a\rangle\langle a| \quad (7.3)$$

$$\langle a|q\rangle = \sum_b \langle a|G|b\rangle \langle b|q\rangle \quad (7.4)$$

$$q_a = \sum_b G_a^b q_b \quad (7.5)$$

$$\overleftarrow{a} q = \overleftarrow{a} G \overleftarrow{\sum b} q \quad (7.6)$$

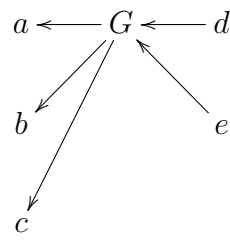
$$\langle q|a\rangle = \sum_b \langle b|G^\dagger|a\rangle \langle q|b\rangle \quad (7.7)$$

$$q^a = \sum_b (G^\dagger)_b^a q^b \quad (7.8)$$

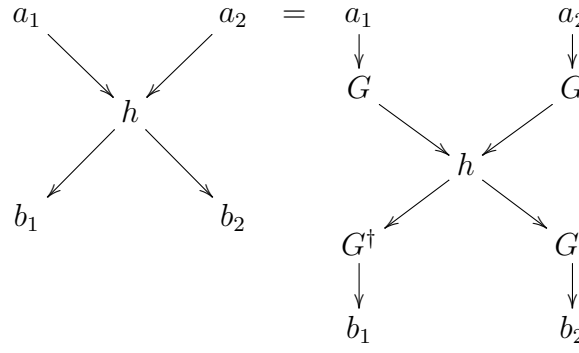
$$q \overleftarrow{a} = q \overleftarrow{\sum b} G^\dagger \overleftarrow{a} \quad (7.9)$$

$$\overleftarrow{a} q = a \longleftarrow q \quad (7.10)$$

$$q \overleftarrow{a} = q \longleftarrow a \quad (7.11)$$

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

(7.12)

$$\langle b_1, b_2 | h | a_1, a_2 \rangle = \langle G^\dagger b_1, G^\dagger b_2 | h | G a_1, G a_2 \rangle \quad (7.13)$$

$$=$$

(7.14)

$$G_b^a = \delta_b^a + i \sum_j \epsilon_j (T_j)_b^a \quad (7.15)$$

$$\overleftarrow{}_b G \overleftarrow{}_a = \overleftarrow{}_b \delta \overleftarrow{}_a + i \sum_j \epsilon_j \overleftarrow{}_b T_j \overleftarrow{}_a \quad (7.16)$$

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

$$0 = i \sum_j \epsilon_j \left(\begin{array}{ccc} \begin{array}{c} a_1 \\ \downarrow \\ T_j \\ \searrow \\ h \end{array} & & \begin{array}{c} a_2 \\ \downarrow \\ \delta \\ \swarrow \\ h \end{array} \\ & & \\ \begin{array}{c} \delta \\ \swarrow \\ h \end{array} & & \begin{array}{c} \delta \\ \searrow \\ h \end{array} \\ & & \\ \begin{array}{c} \delta \\ \downarrow \\ b_1 \end{array} & & \begin{array}{c} \delta \\ \downarrow \\ b_2 \end{array} \end{array} + \begin{array}{ccc} \begin{array}{c} a_1 \\ \downarrow \\ \delta \\ \searrow \\ h \end{array} & & \begin{array}{c} a_2 \\ \downarrow \\ T_j \\ \swarrow \\ h \end{array} \\ & & \\ \begin{array}{c} \delta \\ \swarrow \\ h \end{array} & & \begin{array}{c} \delta \\ \searrow \\ h \end{array} \\ & & \\ \begin{array}{c} \delta \\ \downarrow \\ b_1 \end{array} & & \begin{array}{c} \delta \\ \downarrow \\ b_2 \end{array} \end{array} \right) \quad (7.17)$$

$$- i \sum_j \epsilon_j \left(\begin{array}{ccc} \begin{array}{c} a_1 \\ \downarrow \\ \delta \\ \searrow \\ h \end{array} & & \begin{array}{c} a_2 \\ \downarrow \\ \delta \\ \swarrow \\ h \end{array} \\ & & \\ \begin{array}{c} T_j \\ \swarrow \\ h \end{array} & & \begin{array}{c} \delta \\ \searrow \\ h \end{array} \\ & & \\ \begin{array}{c} T_j \\ \downarrow \\ b_1 \end{array} & & \begin{array}{c} \delta \\ \downarrow \\ b_2 \end{array} \end{array} + \begin{array}{ccc} \begin{array}{c} a_1 \\ \downarrow \\ \delta \\ \searrow \\ h \end{array} & & \begin{array}{c} a_2 \\ \downarrow \\ \delta \\ \swarrow \\ h \end{array} \\ & & \\ \begin{array}{c} \delta \\ \swarrow \\ h \end{array} & & \begin{array}{c} \delta \\ \searrow \\ h \end{array} \\ & & \\ \begin{array}{c} \delta \\ \downarrow \\ b_1 \end{array} & & \begin{array}{c} \delta \\ \downarrow \\ b_2 \end{array} \end{array} \right) \quad (7.18)$$

from which we get one equation for each ϵ_j .

Bibliography