QCCS reduction semantics

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Introduction

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Background

In this chapter, we review some fundamentals concepts in quantum computing and formal methods.

2.1 Quantum Computing

The laws on Quantum Mechanics, as we understand them, are elegantly formalized in a mathematical framework, built upon simple linear algebra. This framework is based on a few postulates that describe the behaviour of quantum systems. Since quantum computing is just the technique of manipulating quantum systems to perform some computation, it must follow the same postulates.

First we recall some basic definition from linear algebra, formulated in the Dirac's "bra-ket" notation, and then we present the postulates that apply to quantum computing. For further reading, the standard textbook on the subject is [1].

Definition 2.1.1. A column vector is written $|\psi\rangle$, and it's called "ket of ψ"

$$|\psi\rangle = \begin{pmatrix} \alpha_1 \\ \dots \\ \alpha_n \end{pmatrix}$$

while its conjugate transposed is writted $\langle\psi|$

$$\langle\psi| = |\psi\rangle^\dagger = (\alpha_1^*, \dots, \alpha_n^*)$$

A Hilbert space, often denoted as $\mathcal{H}$, is a complex inner product space, i.e. etc etc

orthogonal vectors

tensor product on hilbert spaces

2.1.1 State vector

2.1.2 Unitary Transformation

2.1.3 Measurement

2.1.4 Density matrix formalism

2.2 Process Calculi

Capitolo 3

chapter 3

Capitolo 4

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Conclusions

Bibliography

[1] Michael A. Nielsen e Isaac L. Chuang. *Quantum Computation and Quantum Information: 10th Anniversary Edition*. Cambridge University Press, 2010. DOI: 10.1017/CBO9780511976667.