Resources

A collection of resources for math, computer science, and quantum enthusiasts

Quantum Information Science

Quantum Algorithms

Courses

- **Sevag Gharibian's Introduction to Quantum Computation Course**

This is my favorite 101 course on quantum computing. If you are a computer scientist, I believe this course is the best choice if you want to start learning about quantum computing.

- **Simon Apers' Quantum Algorithms Course Notes**

A compact set of notes on some quantum algorithms that are not usually covered in a 101 course on quantum computing: adiabatic quantum computing, quantum walks, and quantum Hamiltonian simulation.

Survey Articles

- **Quantum algorithms for algebraic problems** by Andrew M. Childs and Wim van Dam

This is an excellent source for learning about a large class of quantum algorithms that are similar to the seminal algorithm by Peter Shor for factoring integers. My suggestion to beginners is to start with reading Appendix B, then move on to Section III.[1]

[1] Childs also has a set of lecture notes on quantum algorithms that may be helpful in reading this survey.

ZX-Calculus

Survey Articles

- **ZX-calculus for the working quantum computer scientist** by John van de Wetering

A wonderful easy-to-read and succinct introduction to ZX-calculus. If you are completely new to ZX, I believe that reading Section 3-6 and Section 10 will give you an idea of what ZX-calculus is and how it is useful.

Books

- **Picturing Quantum Software** by Aleks Kissinger and John van de Wetering
- **New Structures for Physics**, edited by Bob Coecke

Quantum Information Theory

Courses

- A short course on quantum information theory by Omar Fawzi

Quantum Complexity Theory

- **Quantum Computational Complexity** by John Watrous
- **Quantum Hamiltonian Complexity** by Gharibian et al.

- **Quantum Proofs** by Thomas Vidick and John Watrous

Classical Complexity Theory

Books

- **Structural Complexity I and II** by José Luis Balcázar , Josep Díaz , Joaquim Gabarró

This is a rather old book, but I think it is the best for someone who is new to complexity theory, and wants to learn the *classical* results. I personally prefer it over the popular book by Arora and Barak, and I am sure once you start reading it, you will see that it is a result of a great deal of effort over many years, making it different from those books that are not-carefully-revised compilations of lecture notes.

- **Mathematics + Computation** by Avi Wigderson

I wouldn't be able to express how much I love this book, and I won't even try. The author is one of the most influential computer scientists and mathematicians of our time, and he has gathered a little bit of everything in this book. Nevertheless, those "little bits" are so carefully chosen and subtly well-explained that I believe it has something to offer to everyone, from an undergraduate student to an expert in complexity theory.

Are you a high school student and you want to decide whether to study math in college?

There are many resources that are fairly accessible for a high school student and can give them a taste of what mathematicians do and what mathematics is about.

- **Dialógusok a matematikáról** by Alfréd Rényi

Free copies of English and Persian translations are available online.

Written by a great mathematician. When I used to teach some extra-curricular math classes to high school and middle school students, I usually tried to read parts of this book in the class, and it was often one of the most enjoyable parts of the class for both me and the students.