Quantum Computing for High School Students

Spring 2020 – Jan 29 – May 15

# Instructor Information

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| --- | --- | --- |
| Instructor | Email | Office Location & Hours |
| **Avery Leider** | aleider@pace.edu | Goldstein Academic Center  Room 307 Pace University  Pleasantville, NY  Hours: By appointment |

# General Information

## Description

Quantum Technology is rapidly advancing with major corporate contributors such as IBM, Microsoft, and Google looking towards the future. Quantum computing is in its early stages and has attracted the attention of national governments with cryptography application. Other uses of Quantum computing are believed to create new medications, improve weather tracking with earlier and more precise climate patterns, in addition to developing new materials.

<https://youtu.be/u1XXjWr5frE>

## Expectations and Goals

This introductory course in the exciting and growing field of quantum computing uses only high school algebra and trigonometry.

We will present topics from quantum mechanics, algebra, computer science and cryptography, which form the foundation of the theory of quantum computing.

# Course Materials

## Required Materials

* PDF (Provided) Quantum Computing for High School Students: <https://qubitpublishing.com/gallery/qc-high-2e-with-cover.pdf>
* Ability to connect to virtual classroom

# Course Schedule

| Week | Topic | Reading | Exercises |
| --- | --- | --- | --- |
| Week 1 | Introduction | Pages 1 – 14  <https://www.youtube.com/watch?v=yy6TV9Dntlw> | Enter exercise |
| Week 2 | Cryptography/Linear Transformations | Pages 15 - 29 | Enter exercise |
| Week 3 | The Matrix, Transformations, and Teleportation | Pages 30 - 46 | Enter exercise |
| Week 4 | Group Theory Part I | Pages 47 - 57 |  |
| Week 5 | Group Theory Part II | Pages 58 - 70 |  |
| Week 6 | Cryptosystems | Pages 71 -74 |  |
| Week 7 | Computations | Pages 75 - 85 |  |
| Week 8 | Quantum Gates/Circuits | Pages 80 - 86 |  |
| Week 9 | Fouriers Part I | Pages 90 – 108 |  |
| Week 10 | Fouriers Part II | Pages 109 - 115 |  |
| Week 11 | Shor’s Algorithm | Pages 116 - 123 |  |
| Week 12 | Project Completion |  |  |

# Exam Schedule

| Date | Subject |
| --- | --- |
| Date 1 | Enter subject |
| Date 2 | Enter subject |
| Date 3 | Enter subject |

# Additional Information and Resources

## You Tube

* <https://youtu.be/u1XXjWr5frE> - Why Quantum Computing?
* <https://youtu.be/jhXCTbFnK8o> - Cryptography
* <https://youtu.be/UiJiXNEm-Go> = How to improve encryption
* <https://youtu.be/rowWM-MijXU> - The Matrix Explained