Intro to QC Lektion1- Overview

**Intro:**

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| **Outline** | **Script** |
| **Hook** (Why should students continue on in this lecture) | Hi – My name is Tom Stevns and I am teacher at KEA’s department for Computer science.  I will be pleased to introduce you to the course Introduction to Quantum Computing  So why introducing this course at KEA, well You see for the time being this topic is extremely interesting because this technology will probably already during the end of this reach this very hyped level called Quantum Supremacy , which means that just one single QC will have the capability to out perform the entire performance of all computers in the world. And even more spectacular it will have the capability to execute common computer-routines on Super-computers that normally would take more time than the age of the universe in just a split of a second.  And moreover You will be able to participate in danish Quantum Startup Companies like MQS.dk  I claim that a technology with this force is worth a course for the decisions in your career to come so I look forward to meet you and hope that you consider to attend the course –  So welcome to all of You |
| **1-2 Sentence Overview** (Prime the students for what’s to come) | In this lecture, we’re going to walk you through the entire course   * Introduction to Quantum mechanics * Quantum algorithms * Onsite exercises/evaluations * Your Final and mandatory Report * “Quantum Computing Explained” Chapter 1 |
| **Preview** (Show what tangible/visible skill they’ll achieve by the end of the lecture) | So during this week we will startup slowly to introduce You to QC as well as I look forward to to learn and know you and not least to hear about your own expectations. I would like to make the course as interesting to you as possible and there are many topics to choose and change along the way |

**Body:**

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| **Outline** | **Script** |
| **Main Point 1** | With this course, I want to give the student the opportunity to understand the basic concepts of a technology as in a few years, most likely, will change the classic way of working with IT systems dramatically. You will be introduced to the quantum mechanical phenomena that form the basis of Quantum Computing such as: Superposition, Entanglement, Bell states etc. In addition, you also understand how to work with qubits, quantum gates and develop small python simulation tasks. Of course, you will also be taught in the part of mathematics that supports Quantum Computing, but I want to emphasize that the level is easy such as: phytagoras and two equations with two unknowns, so it will be as self contained as possible – Kanban method if You like. I am for the time beeing working on the opportunity to prepare this course exercises at the most recognized research institutions in Denmark, this because it would be a remarkable experience for You, but so far I can’t garantie, but let’s see |
|  | From L1 to L11 there will in general be repetion, common exercises, visualized films and your report writing for exam. The common easy exercises should be delivered as weekly assignment in Fronter. |
| **L1** | * Double Split Experiment * <https://www.dr.dk/tv/se/store-danske-videnskabsfolk-saeson-2/store-danske-videnskabsfolk/store-danske-videnskabsfolk-niels-bohr#!/> * Nature of light <https://www.youtube.com/watch?v=XB-iLRsq8A8> * 2 <https://www.youtube.com/watch?v=KQ3PkBbuE4M&list=PL2jykFOD1AWap0r8WOuZ-08BFgMyx-5RT&index=2> * 3 <https://www.youtube.com/watch?v=I7xZXXJ3Bjk&list=PL2jykFOD1AWap0r8WOuZ-08BFgMyx-5RT&index=3> * 4 |
| **L2** | * 6-Qubits * 7-Geometric representation part1 * 8-Geometric representation part 2 * 9-Uncertainty Principle * 10-K-Level BRA-KET |
| **L3** | * 11-Two Qubits * 12-Entanglement * 13-EPR Paradox |
| **L4** | * 14-EPR Paradox – Test * 15 Rotational invariance of of Bell state * 16-CHSH inequality (Game) * 17-Bell & Local realism * 18-Certifying randomness |
| **L5** | * 19-Axioms of Quantum Systems * 20-Unitary transformations * 21-Single Qubit Gate * 22-Optional maybe/maybe not |
| **L6** | * 23-Teleportation No cloning Teorem * 24-Bell state circuit 4 states * 25-Teleportation part 1 * 26-Teleportation part 2 * 27-Measurement |
| **L7** | * 28-N-Qubit Strength * 29-Manipulating N Qubits * 30-Universal family af Quantum Gates * 31-Reversible Computation part 1 * 32-Reversible Computation part 2 |
| **L8** | * 33-Fourier sampling part1 * 34-Fourier sampling part 2 * 35-Simons algorithm * 36-Two to the N-split Experiment * 37-Extended Church Turing thesis |
| **L9** | * 38-Quntum Fourier transform(QFT) overview * 39-N'th root of unity * 40-QFT'n part 1 * 41-QFT'n part 2 * 42-QFT'n properties |
| **L10** | * 43-Quantum Factoring-Period finding * 44-Quantum Factoring-Shors algoritm * 45-Optinal Quantum Factoring cirquit |
| **L11** | * 46-Needle in a Haystack * 47-Search Grovers Algorithm * 48-Search Implementing Grovers Algorithm |
| **L12** | * Architecture |
| **L13** | * Preparation for DFM/Optional |
| **L14** | * Preparation for NBI/Optional |
| **L15** | * Optional |
| **L16** | * Optional |

**Conclusion:**

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| **Outline** | **Script** |
| **Review of Key Points** (Repetition helps concepts stick in people’s minds so reiterate the main points you covered) | I have now introduced to the topics of this course, if You are interested feel free to check out on the internet for finding further information. |
| **Teaser for Next Lecture** (Viewership typically drops off after a lecture but encourage students to continue learning by whetting their appetite for the next lecture) | In the next week will begin to talk about   * Qubits * Geometric representation * Uncertainty Principle |