

Čo je



a jeho aktivity

Denisa Lampášová

KTO JE

QWORLD ?

Globálna sieť jednotlivcov, skupín a komunit spolupracujúcich na vzdelávaní, implementovaní kvantových technológií a na výskumných aktivitách.

ČO ROBÍ

QWORLD ?

Popularizuje kvantové technológie a kvantový softvér a snaží sa prilákať viac ľudí do tejto oblasti.

CIEĽ

Do roku 2025 vytvoriť otvorene prístupný verejný globálny ekosystém pre kvantové technológie a softvér, do ktorého je jednoduché sa zapojiť.



QEDUCATION

Vytváranie
voľne
dostupných
materiálov a
trénovanie
inštruktorov.



QRESEARCH

(Medzinárodná)
spolupráca na
výskumných
projektoch.
QIntern.



QCOUSINS

Lokálne
kvantové
skupiny
organizujúce
akcie v ich
regióne.

21

Q COUSINS

3 ÁZIA

Q | RUSSIA >

Q INDIA

Q PAKISTAN

Q TUNISIA Q Zimbabwe

Q Nigeria Q | LIBYA >

Q Morocco Q Egypt

6 AFRIKA

11 EURÓPA

Q IRELAND

Qspain

Q Latvia SOFTWARE

Q Greece

Q < Romania |

Q | Mexico >

Q | SLOVAKIA

Q CZECH going quantum

Q Poland

Q HUNGARY

Q BALKAN

Q | Turkey >

1 SEVERNÁ AMERIKA

QDrive Family

- |0> Riga, Latvia
- |1> Ankara, Turkey
- |2> Cracow and Warsaw, Poland
- |3> Brno, The Czech Republic
- |4> Kosice, Slovakia
- |5> Budapest, Hungary
- |6> Podgorica, Montenegro
- |7> Sarajevo, Bosnia and Herzegovina
- |8> Ljubljana, Slovenia

Thank You!

May - July 2019

QLatvia SOFTWARE



Abuzer Yakaryilmaz

Maxim Dimitrijevs
Agnieszka Wolska
Aleksejs Naumovs

QDrive Team

Dr. Abuzer Yakaryilmaz,
Dr. Maksims Dimitrijevs, Aleksejs Naumovs,
Agnieszka Wolska

Our summary

11 workshops in eight countries
200 hours of workshops
209 handed out diplomas
41 diplomas "Power of women"
79 days of traveling
10 560 kilometers of driving

May - July 2019

QDrive@Košice

26.-28. jún 2019



Tutoriály & Workshopy

QWebinars & QTalks

Hackethony

legálne registrovaný
20. Novembra 2020

QIntern

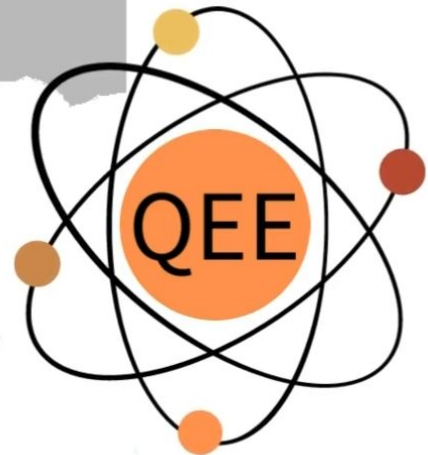
QDrive 2019

Semestrálne kurzy

Quantum Eastern Europe



5.-6. Máj 2022



WORKSHOPY

QPrep

Basic
python and
linear
algebra.

QBronze

Základy
kvantového
počítania.

QNickel

Elementary
level.
Oracular
algorithms.

QSilver

Intermediate
-level.
Complex
numbers, QFT
& Shor's
Algorithm.

<https://gitlab.com/qworld>



DIPLOMA

presented to

Denisa Lampášová

for successfully completing QNickel workshop on
Quantum Computing & Programming
focusing on oracular quantum algorithms,
using QWorld's elementary level tutorial Nickel.

Özlem Salehi

Özlem Salehi
QWorld & QTurkey

Jibrán Rashid

Jibrán Rashid
QPakistan

Diploma Number: QNickel1-9

QWORLD

APRIL
2021



DIPLOMA

presented to

Denisa Lampášová

for successfully completing QSilver workshop on
Quantum Computing & Programming
focusing on complex numbers and Shor's algorithm,
using QWorld's intermediate level tutorial Silver.

Özlem Salehi

Özlem Salehi
QWorld & QTurkey

Abdullah Khalid

Abdullah Khalid
QPakistan

Maksims Dimitrijevs

Maksims Dimitrijevs
QWorld & QLatvia

Diploma Number: QSilver1-10

QWORLD

APRIL
2021



SLOVAKIA

RCQI členovia:

Denisa Lampášová
Daniel Nagaj
Daniel Reitzner
Michal Sedlák
Mário Ziman

UPJŠ členovia:

Alexander Feher
Martin Gmitra
Ondrej Krídlo
Viktor Olejár ← **koordinátor**
Tomáš Samuely
Gabriel Semanišin

QDrive@Košice

26.-28. jún 2019

QBronze

6.-10. jún 2022

QSilver

21.-25. jún 2022

QBronze 6.-10. jún 2022



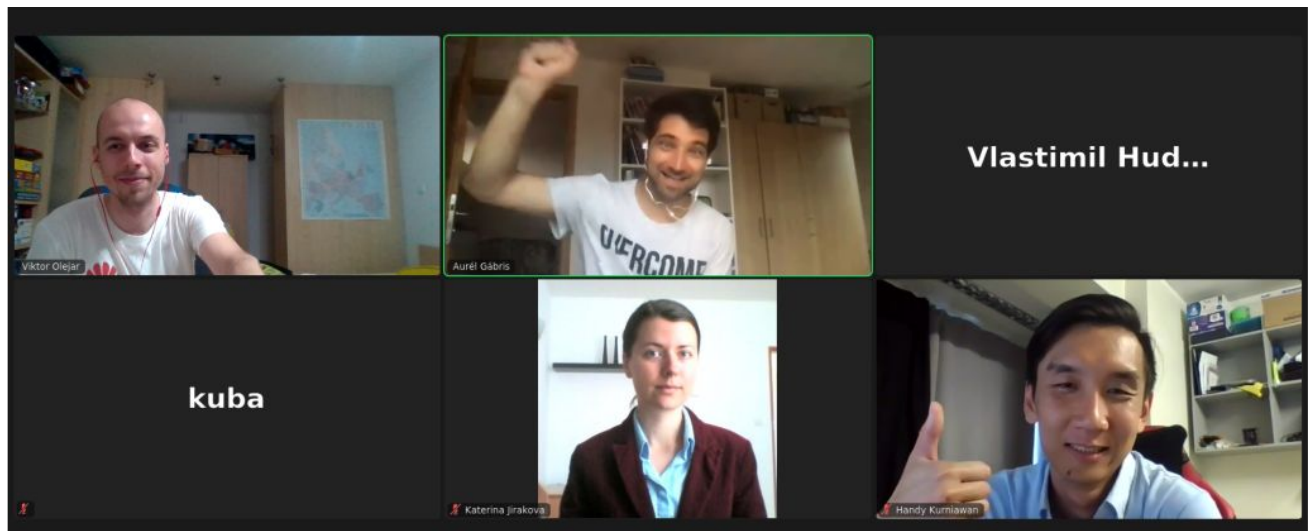
Tom

Tobiáš K.

Omar

QSilver

2.-10. jún 2022



Vlastimil Hud...

kuba

Handy Kurniawan

	Prihlásení	Reálne začalo	Úspešní
QBronze	37	30	17 (~46%)
QSilver	13	11	7 (~54%)

QBronze

7 žien
z 37 prihlásených
(~21.6%)

Stredoškooláci: ~56.5%

Uni študenti: ~30%

Iné: ~13.5%

QSilver

3 ženy
z 13 prihlásených
(~23%)

15-18 rokov: ~23%

19-27 rokov: ~54%

30+ rokov: ~23%

QBronze

Python review

[Jupyter notebooks](#) | [Variables](#) | [Loops](#) | [Conditionals](#) | [Lists](#) | [Python Reference](#) | [Drawing Reference](#)

Basic math

[Vectors](#) | [Dot Product](#) | [Matrices](#) | [Tensor Product](#) | [Exercises](#)

Basics of classical systems

[One Bit](#) | [Coin Flipping](#) | [Coin Flipping Game](#) | [Probabilistic States](#) | [Probabilistic Operators](#) | [Two Probabilistic Bits](#)

[Exercises](#) | [Problem Set](#) | [Correlation \(advance\)](#) | [Operators on Multiple Bits \(advance\)](#)

Photons

[Quantum Coin Flipping](#)

Qiskit basics

[Qiskit installation and test](#) | [First Quantum Programs with Qiskit](#) | [Qiskit Reference](#)

Basics of quantum systems

[Hadamard Operator](#) | [One Qubit](#) | [Quantum State](#) | [Visualization of a \(Real-Valued\) Qubit](#) | [Superposition and Measurement](#) | [Exercises](#)

Quantum operators on a (real-valued) qubit

[Operations on the Unit Circle](#) | [Rotations](#) | [Reflections](#) | [Quantum Tomography](#) | [Exercises](#)

Entanglement and protocols

[Two Qubits](#) | [Phase Kickback](#) | [Entanglement and Superdense Coding](#) | [Quantum Teleportation](#) | [Multiple Control Constructions](#) | [Exercises](#)

Grover's search algorithm

[Inversion About the Mean](#) | [Grover's Search: One Qubit Representation](#) | [Grover's Search: Implementation](#)

Problem Definition

Given a positive integer N , what prime numbers when multiplied together equal to N ?

It should also be noted that the converse is an easy problem. If the prime numbers are already given, they can be multiplied to check whether they are really the factors of N . This property of the problem lies at the center of encryption algorithms which is widely used today. Therefore, quantum computing poses a big challenge for cryptographic systems.

It was already known that factorization problem can be reduced to order finding problem. Shor was able to find the polynomial time algorithm for order finding which overall resulted in a polynomial time algorithm for the factorization problem. At the background of Shor's algorithm lies the exponential speed up that comes from Quantum Fourier Transform.

Factoring 21

Now we are ready to factor 21, using the phase estimator circuit we have already implemented.

Task 4 ¶

Factor 21 using Shor's Algorithm.

- Pick a random x which is relatively prime with 21.
- Apply phase estimation circuit to the operator U_x .
- Use continued fractions algorithm to find out r .
- Compute $\gcd(x^{r/2} - 1, N)$ and $\gcd(x^{r/2} + 1, N)$

```
In [1]: N=21
```

```
In [ ]: #Pick a random x relatively prime with N
```



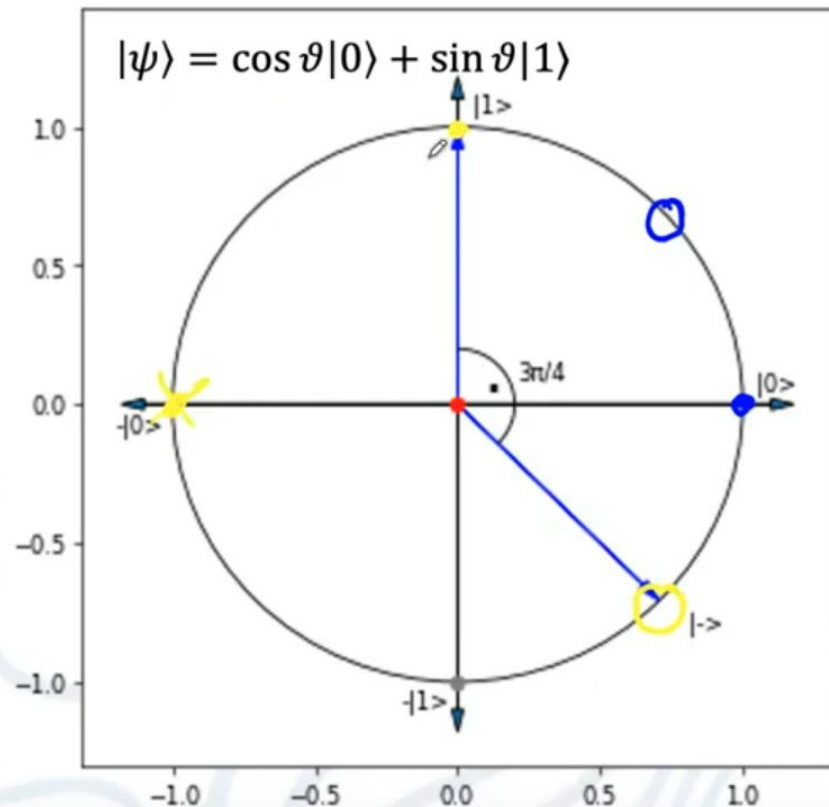

Reflections

$$\det M = -1$$

$$H = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix} \quad -1-1 = -2$$

$$H|0\rangle = \frac{1}{\sqrt{2}} (|0\rangle + |1\rangle) = |+\rangle$$

$$H|1\rangle = \frac{1}{\sqrt{2}} (|0\rangle - |1\rangle) = |-\rangle$$



INTERNAL



crew

testing-channel

crew-voice

June 21, 2022



LaksV 06/21/2022
good day Mentors, should we create separate conda environment for qiskit and QuTip?

Viktor Olejár 06/21/2022
Hi, I would put everything in the same environment regarding this workshop. What I mean is you can create a QSilver environment if you would like and put all the necessary packages there.
👍 1

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It will be removed in cirq v0.15.
Foxtail will no longer be supported.

is this wrong? or should I install previous versions of cirq? (edited)
👍 2

Denda 06/21/2022
I believe you're doing it right :-). The official documentation says you can access Foxtail device via `cirq_google.Foxtail` (<https://quantumai.google/cirq/google/devices#foxtail>). Note: Cirq v0.14.1 is the latest version and in the coming releases Foxtail will be removed (for reference: <https://github.com/quantumlib/Cirq/releases>). I believe this is not relevant for this course and we should eventually (soon) change it in the notebooks (i.e. use some other device, not Foxtail) :).
Conclusion: The 1st cell should be:

```
import cirq_google
print(cirq_google.Foxtail)
```

And ignore the DeprecationWarning if the output gives you what the comment says :)

INTERNAL



crew

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June 21, 2022



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GENERAL



general

!?-report-typos

code-of-conduct

feedback-form

suggestions

PROGRAM

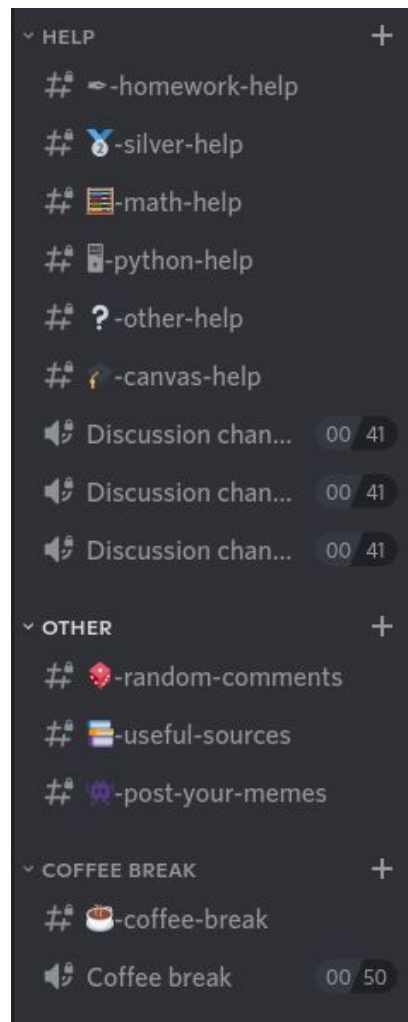
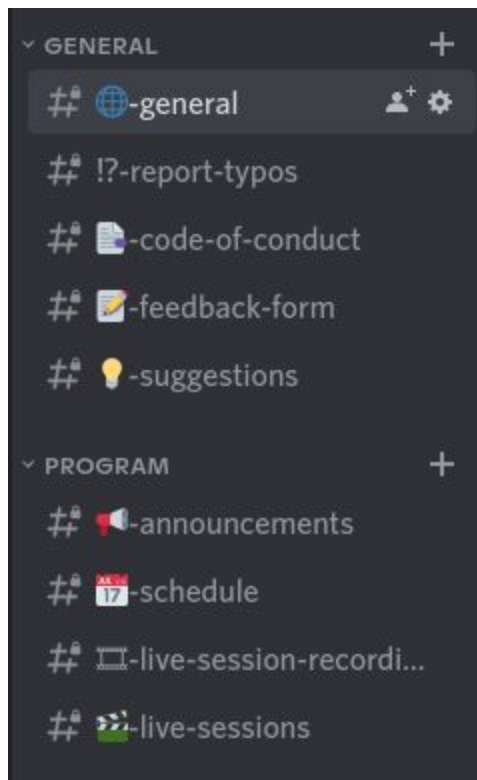
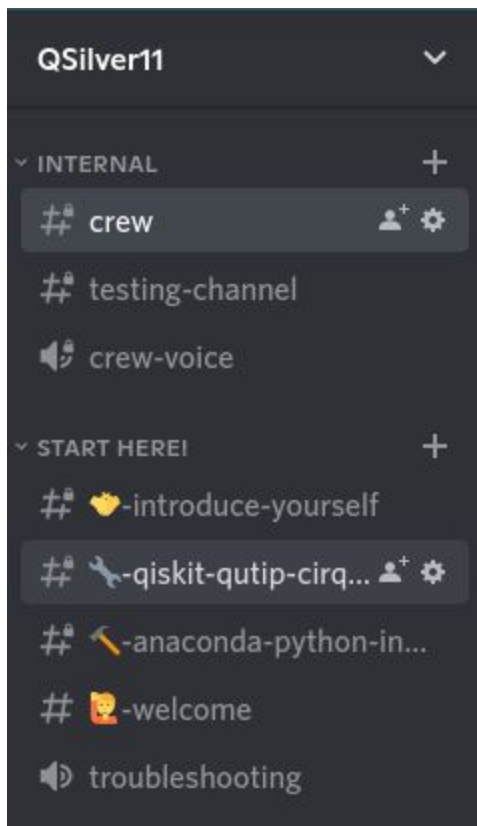


announcements

schedule

live-session-recordi...

live-sessions





Question 1

2 pts

[D01-01] Use pen and paper to compute DFT of $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$.

$\begin{pmatrix} \frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} \end{pmatrix}$

$\begin{pmatrix} \frac{3}{\sqrt{2}} \\ -\frac{4}{\sqrt{2}} \end{pmatrix}$

$\begin{pmatrix} \frac{7}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} \end{pmatrix}$

$\begin{pmatrix} \frac{3}{\sqrt{2}} \\ \frac{4}{\sqrt{2}} \end{pmatrix}$



21

QCOUSINS



27

COUNTRIES VISITED



104

NUMBER OF EVENTS

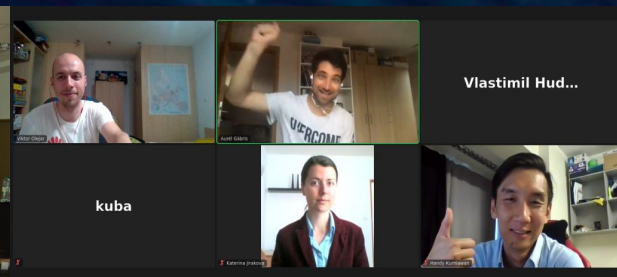


4,238

DIPLOMAS HANDED OUT



SLOVAKIA



QDrive@Košice

26.-28. jún 2019

QBronze

6.-10. jún 2022

QSilver

21.-25. jún 2022

QWorld

We invite everyone
to be part of the second
quantum revolution!



Ďakujem za pozornosť 😊