Quantum Computing and Cryptography - 09: Probabilistic to Quantum Systems

Length	Nanomodule
Collection	NSA NCCP
Updated	March 14, 2019
Contributors	Abhishek Parakh
Academic Levels	Undergraduate, Graduate
Topics	Cryptography, Quantum Computing
Link	https://clark.center/details/aparakh/a0ef76d9-36fc-414b-84fe-5ca6d67a8574

Description

This nanomodule introduces the notion of probabilistic systems and then transitions to modeling quantum systems using analogies. It introduces a classroom experiment that illustrates several of the quantum phenomena for an instructor-led discussion.

Email Dr. Abhishek Parakh at aparakh@unomaha.edu for solutions to the problems.

Note: To get started with Jupyter notebooks please follow the userguide available at: https://sites.google.com/unomaha.edu/userguideqcl/

Outcomes

- Restate notion of qubits and types of operations that can be applied to them.
- Define notion of probabilistic systems.
- Model light photons as qubits and determine some of their basic properties with respect to measurement.
- Create probability vectors for probabilistic systems and apply simple operations on them.

Alignment

The standards and guidelines this learning object is mapped to

- CAE Cyber Ops (2014) - Discrete Math: Understand how automata are used to describe computing machines and computation, and the notion that some things are computable and

some are not. They will understand the connection between automata and computer languages and describe the hierarchy of language from regular expression to context file
- NICE Workforce Knowledge (2017) - K0030: Knowledge of electrical engineering as applied to computer architecture (e.g., circuit boards, processors, chips, and computer hardware).
- CAE Cyber Defense (2014) - Probability and Statistics: Students will be able to evaluate probabilities to solve applied problems.
- NICE Workforce Knowledge (2017) - K0052: Knowledge of mathematics (e.g. logarithms, trigonometry, linear algebra, calculus, statistics, and operational analysis).
- CS2013 (2013) - Digital logic and digital systems: Describe the progression of computer technology components from vacuum tubes to VLSI, from mainframe computer architectures to the organization of warehouse-scale computers.
- NICE Workforce Knowledge (2017) - K0302: Knowledge of the basic operation of computers.
- CAE Cyber Defense (2019) - Introduction to Theory of Computation (KU2): Differentiate the characteristics of computable and non-computable functions.
- CAE CDE 2019 (2019) - Introduction to Theory of Computation: Differentiate the characteristics of computable and non-computable functions.

Links

External links that are associated with this learning object

- User guide