KOENIG step forward

Microsoft Solutions Partner
Microsoft Cloud Training Services

KOENIG SOLUTIONS · COURSE OUTLINE

Introduction to Quantum Computing with Azure Quantum and Q#

Learn to build and run quantum programs with Q# and Azure Quantum, from core concepts to resource estimation and optimization.

24 Hours	9	30	18
DURATION	MODULES	TOPICS	HANDS-ON EXERCISES

COURSE OVERVIEW

This course introduces quantum computing with a focus on using Azure Quantum and Q# programming language. Participants will learn the fundamentals of quantum computing, including key concepts such as superposition, interference, and entanglement, and how to implement quantum algorithms using the Quantum Development Kit (QDK) and Azure Quantum services. The course will cover topics such as creating a quantum workspace in Azure Quantum, programming quantum algorithms with Q#, estimating physical resources for quantum algorithms using the Azure Quantum Resource Estimator, running quantum algorithms on quantum hardware, and solving optimization problems using quantum-inspired optimization. Through practical exercises and case studies, participants will gain hands-on experience in developing and running quantum programs with Azure Quantum and Q#.

WHO THIS COURSE IS FOR

This course is suitable for software developers, data scientists, and researchers who are interested in learning about quantum computing and want to get started with using Azure Quantum and Q# for quantum programming

It is also suitable for individuals with a background in computer science or a related field who want to explore the applications of quantum computing in various domains, such as optimization and algorithm design

PREREQUISITES

- Participants should have a basic understanding of programming concepts and some familiarity with a programming language, as well as basic knowledge of linear algebra and probability.
- Familiarity with quantum mechanics or quantum computing is not required, as the course will cover the necessary concepts.

LEARNING OBJECTIVES

What You Will Learn

Upon completing this course, participants will be able to:

- Create a quantum workspace in Azure Quantum
- Write and run quantum programs using Q# and the Quantum Development Kit
- Understand key concepts of quantum computing, including superposition, interference, and entanglement
- Implement and run quantum algorithms, such as Grover's search, using Q# and Azure Quantum
- Estimate physical resources for quantum algorithms using the Azure Quantum Resource Estimator
- Utilize Q# libraries for quantum programming tasks
- Run quantum algorithms on quantum hardware using Azure Quantum services
- Solve optimization problems using quantum-inspired optimization techniques

COURSE SYLLABUS

9 Modules, 30 Topics

01

Get Started with Azure Quantum

TOPICS

- Introduction
- Azure Quantum structure overview
- Create your first Azure Quantum workspace
- Get started with a Jupyter notebook and Q# in Azure Quantum
- Case studies for quantum computing
- Case studies for optimization

02

3 Exercises

Create Your First Q# Program by Using the Quantum Development Kit

TOPICS

Introduction · How are Q# programs structured?

03

3 Exercises

Explore the Key Concepts of Quantum Computing by Using Q#

TOPICS

Introduction · Superposition in quantum computing · Interference in quantum computing · Entanglement in quantum computing · Introduction to quantum algorithms

04

2 Exercises

Solve Graph Coloring Problems by Using Grover's Search

TOPICS

- Introduction
- The search problem
- How to implement classical computation on a quantum computer
- Grover's search algorithm
- Potential applications of Grover's algorithm in practice

05

2 Exercises

Estimate Physical Resources for Quantum Algorithms by Using the Azure Quantum Resource Estimator

TOPICS

Introduction · Resource estimation in quantum computing · The Azure Quantum Resource Estimator

06

3 Exercises

Use the Q# Libraries

TOPICS

Introduction · Q# libraries · Q# API documentation

07

2 Exercises

Run Algorithms on Quantum Hardware by Using Azure Quantum

TOPICS

Introduction · Quantum hardware overview · Different targets in Azure Quantum · Continue experimenting with Azure Quantum

08

3 Exercises

Solve Optimization Problems by Using quantum-inspired Optimization

TOPICS

Introduction

09

Advanced Topics

TOPICS

- Intermediate and Advanced concepts in quantum computing and optimization

HANDS-ON EXERCISES

Practise What You Learn

#	MODULE	ACTIVITY
02	**Create Your First Q# Program by Using the Quantum Development Kit**	■ Install the QDK for Visual Studio Code ■ Create a quantum random bit generator ■ Create a quantum random number generator
03	**Explore the Key Concepts of Quantum Computing by Using Q#**	■ Explore superposition by using Q# and Visual Studio Code ■ Explore interference by using Q# and Visual Studio Code ■ Explore entanglement with Q# and Azure Quantum
04	**Solve Graph Coloring Problems by Using Grover's Search**	■ Implement a quantum oracle for graph coloring problem ■ Implement Grover's algorithm to solve graph coloring problem
05	**Estimate Physical Resources for Quantum Algorithms by Using the Azure Quantum Resource Estimator**	■ Get started with the Azure Quantum Resource Estimator ■ Estimate resources for a real-world problem
06	**Use the Q# Libraries**	■ Write an oracle to validate ISBNs ■ Run Grover's algorithm ■ Write your own documentation
07	**Run Algorithms on Quantum Hardware by Using Azure Quantum**	■ Submit a job to Azure Quantum ■ Solve a simple Grover's Search with Q# and an Azure Quantum notebook
08	**Solve Optimization Problems by Using quantum-inspired Optimization**	■ Implement a quantum-inspired optimization algorithm ■ Solve a combinatorial optimization problem ■ Solve a job shop scheduling optimization problem

WHAT IS INCLUDED

Everything You Need to Succeed

- Koenig course material for every module
- Delivery by certified instructors and subject matter experts
- Hands-on exercises throughout the course
- Course completion certificate from Koenig

ABOUT KOENIG

Who We Are

Established in 1993, Koenig Solutions is a globally recognised training provider with 35+ technology partnerships, 5,000+ training programmes and a network of certified instructors and subject matter experts, supporting individuals and enterprise teams worldwide.

FLEXIBLE DELIVERY

Learn the Way That Suits You

Classroom Training | Live Online Classes (ILO) | Fly-Me-A-Trainer (FMAT) | Flexi (Self-Paced) | 1-on-1 Training

Ready to Get Started?

Talk to a learning advisor about schedules, group training and customised delivery.

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