



Quantum Programming - Core

Course Description

Quantum computing can provide significant, practical value for businesses by finding efficiencies, reducing waste, and solving a myriad of complex problems. This hands-on training allows you to identify and clarify problems that can benefit from quantum computing, then start solving those problems using D-Wave's quantum annealing computers and hybrid solvers. You'll learn how to break down an optimization problem into its objectives and constraints, develop mathematical models of the problem, write programs to run on D-Wave's solvers, and interpret returned solutions.

This one-week, online course includes recorded presentations, quizzes, and coding assignments, along with live office hours with an expert instructor. Throughout the course, you'll have access to the Leap community to share new ideas and skills.

Quantum Programming - Core includes access to D-Wave's Leap™ Quantum Cloud Service for the duration of the course. Upgrading to **Quick Start Leap Access** gives you a *full month* of real-time access to our Advantage™ quantum computers and hybrid solver services! Start your end-to-end quantum journey with the support of our software development kit, demos, Jupyter notebooks with live code, and a vibrant developer community.

Learning Objectives

After successfully completing this course, you will be able to:

- Examine different problems in your area of interest for suitability for D-Wave's products.
- Break down an optimization problem into distinct objectives and constraints.
- Formulate an optimization problem as a quadratic model.
- Write an Ocean program to run on D-Wave's quantum computer and hybrid solvers.

Prerequisites

There are no formal prerequisite courses you need to complete before starting this training. Anyone with basic Python, math, and logic skills can succeed. To comfortably complete the course in one week, we recommend having the following additional knowledge:

- Intermediate Python programming experience
- Comfort working with equations and graphs
- Familiarity with matrix operations

Course Agenda

This course runs for one week, with live instructor office hours offered each day during the week. If needed, learners have an additional one-week grace period to complete assignments. Most learners report spending about 30 hours in total to complete the course.

We recommend the following sequence to complete the course most effectively:

Day 1: Course Overview

- Overview of D-Wave Products and Solutions
- Math and Python Review
- Introduction to Ocean™ Software Development Kit (SDK)
- Live office hours

Day 2: Problem Formulation

- Describing Optimization Problems
- Introduction to the Hybrid Solvers
- Constrained Quadratic Model (CQM)
- Live office hours

Day 3: QUBOs and Penalty Functions

- Introduction to QUBO and Ising Models
- Developing QUBOs
- Working with Penalty Functions
- Programming with the BQM Hybrid Solver
- Live office hours

Day 4: Ocean, Objectives, and Constraints

- Ocean and Embedding
- Ocean for Problems with Objectives
- Ocean for Problems with Constraints
- Live office hours

Day 5: D-Wave Solvers

- Expert presentation on Benchmarking
- When to Use Each D-Wave Solver
- Expert presentation on Portfolio Optimization
- Live office hours

Registration

For more information and pricing details, please visit <https://learn.dwavesys.com/catalog>. For assistance, contact training@dwavesys.com.