QC ACADEMY by Digital Learning Hub_

Quantum Computing

Quantum Computing Academy Assessment Overview

The Quantum Computing Academy assessment consists of two parts:

- a Quiz
- a Project assessment using Python

Below, you will find details and examples of the types of questions you may encounter, as well as the main areas that will be evaluated.

Quiz

This quiz evaluates fundamental knowledge in mathematics, linear algebra and statistics, focusing on essential principles that support analytical and quantitative reasoning.

The objective is to measure comprehension of key mathematical relationships and statistical ideas that form the foundation for further study and application in data-driven disciplines.

Example Questions

Question 1

Compute the sum of the vectors: $\vec{u} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, \quad \vec{v} = \begin{pmatrix} 4 \\ 5 \\ 6 \end{pmatrix}$

A) $\begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \end{pmatrix}$

B) $\begin{pmatrix} 5 \\ 7 \\ 9 \end{pmatrix}$ ✓

C) $\begin{pmatrix} 4 \\ 5 \\ 6 \end{pmatrix}$

D) $\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$

Question 2

Compute the product of the following matrices: $A = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}, \quad B = \begin{pmatrix} 3 & 0 \\ 1 & 2 \end{pmatrix}$

A) $\begin{pmatrix} 3 & 2 \\ 0 & 2 \end{pmatrix}$

B) $\begin{pmatrix} 5 & 4 \\ 1 & 2 \end{pmatrix}$ ✓

C) $\begin{pmatrix} 1 & 4 \\ 0 & 2 \end{pmatrix}$

D) $\begin{pmatrix} 4 & 2 \\ 0 & 1 \end{pmatrix}$

Question 3

For the matrix $A = \begin{pmatrix} 6 & 4 \\ 3 & 2 \end{pmatrix}$

☐ The determinant of A is −2.
☑ The determinant of A is 0
☐ The determinant of A is 5.
☐ Matrix A is invertible.
☑ Matrix A is not invertible

Question 4

Find the roots of the following equation: $x^2 - 4x + 3 = 0$

☑ x = 1 or x = 3
☐ x = −1 or x = −3
☐ x = 0 or x = 3
☐ x = 2 only
☐ No real solution

Question 5

Compute the derivative of the function: $f(x) = 3x^3 - 5x^2 + 2x - 7$

☐ $f'(x) = 3x^2 - 5x + 2$
☑ $f'(x) = 9x^2 - 10x + 2$
☐ $f'(x) = 9x^2 - 5x + 2$
☐ $f'(x) = 3x^2 - 10x + 2$

Project Assessment

This assessment is designed to test your ability to solve algorithmic and mathematical problems using Python, while following clean coding practices and project structure standards.

Through a set of practical tasks, you will demonstrate your capacity to:

- Manipulate lists and matrices effectively
- Apply algorithmic logic to solve structured problems

The goal of this assessment is to evaluate your problem-solving mindset and your ability to design reliable, executable Python solutions.

Example Task: Array Concatenation

Task description:

Write a function `cat_arrays(arr1, arr2)` that concatenates two lists of integers or floats.

Requirements:

- Both `arr1` and `arr2` are lists.
- Return a **new list** that combines them (do not modify the originals).
- You cannot use external libraries.

Solution Example (1-concat.py)

```
#!/usr/bin/env python3
"""
Module for concatenating two arrays.
"""
def cat_arrays(arr1, arr2):
    """Concatenates two arrays without modifying them."""
    return arr1 + arr2
```

Explanation:

- The function takes two lists and returns a new one combining their elements.
- Using + ensures a new list is created rather than altering `arr1` or `arr2`.
- The file includes proper documentation and a shebang line for execution.