4.2 Solving the Traveling Salesman Problem with QUBO Formulation (Terra Quantum) (Session: July 13)

Due 31 Jul at 21:59 **Points** 10 **Questions** 5
Available 12 Jul at 22:00 - 31 Jul at 21:59 **Time limit** None
Allowed attempts 3

Take the quiz again

Attempt history

	Attempt	Time	Score
LATEST	Attempt 1	5 minutes	7.33 out of 10

ⓘ Correct answers are hidden.

Score for this attempt: **7.33** out of 10
Submitted 14 Jul at 13:57
This attempt took 5 minutes.

Question 1

2 / 2 pts

Which statements about VQA are true:

(*Hint: There can be more than one correct answer!)*

- [x] VQAs share a common structure, where a task is encoded into a parameterized cost function that is evaluated using a quantum computer, and a classical optimizer trains the parameters in the VQA.

- [x] Variational quantum algorithms (VQAs) are among the leading proposal for achieving quantum advantage using near-term quantum computers.

VQAs cannot be executed on real Quantum processors, only on simulators, as you need to compute the exact expectation value.

VQAs have been developed for a wide range of applications, including finding ground states of molecules, simulating dynamics of quantum systems and solving linear systems of equations.

Question 2

2 / 2 pts

What does the term QUBO stand for?

- Quantum Unlimited Best Optimization
- Quadratic Unconstrained Binary Optimization
- Quantum Unconstrained Binary Optimization
- Quantum Unitary Bi-sectual Optimization

Partial

Question 3

1.33 / 2 pts

Which of the following statements are true:

(*Hint: There can be more than one correct answer!)*

A binary variable b ={0,1} is frequently mapped to eingenstates of the Pauli-Z operators with eigenvalues +1/-1

- [ ] A binary variable b ={0,1} can be encoded into any two points on the 3D sphere (R3)

- [ ] A binary variable b={0,1} can be encoded onto the axis of any two opposed lying points on the bloch sphere

- [x] The quadratic part , i.e. product of two binary variables, is mapped to a tensor product of 2 Pauli-Z operators

Question 4

2 / 2 pts

The variational principle ensures:

(*Hint: There can be more than one correct answer!)*

- [x] The lowest eigenvalue is a lower boundary for the values of the expectation value

- [ ] All eigenvalues with corresponding eigenstates can be determined via variational algorithms

- [ ] Only the highest eigenvalue (which is equivalent to the ground energy state) of the hamiltonian can be approximated

- [x] If the optimizer finds solution parameters for the lowest eigenvalue, you can determine the corresponding eigenstate by constructing the circuit with these parameters and apply a measurement

Incorrect

Question 5

0 / 2 pts

The Ising Model, named after physicists Ernst Ising and Wilhelm Lenz, is a mathematical model of ferromagnetic in statistical mechanics. The model consists of discrete variables that represent magnetic dipole moments of atomic "spins" that can be in one or two states (+1 and -1). Which of the following statements can be true?

(*Hint: There can be more than one correct answer!)*

- [x] The related Hamiltonian is: H(σ)=$\sum_{<i,j>} Q_{ij}\sigma_i\sigma_j - \mu\sum_j h_j\sigma_j$
- [ ] The Ising model without an external field (h_i=0) can be equivalently formulated as a Max-Cut problem that can be solved via QUBO.
- [ ] The identity $\sigma \longrightarrow x, x \in \{0,1\}$ yields an equivalent QUBO problem $f(x) = \sum_{i=1}^{n}\sum_{j=1}^{i} Q_{ij}x_ix_j + C$
- [x] Applying $\sigma \longrightarrow 2x-1, x \in \{0,1\}$ yields an equivalent QUBO problem $f(x) = \sum_{i=1}^{n}\sum_{j=1}^{i} Q_{ij}x_ix_j + C$
- [ ] The constant C has no relevance in our QUBO formalism and can be ignored completely

Quiz score: **7.33** out of 10