QHOS is a hybrid quantum-classical algorithm designed to solve complex optimization problems with a large search space. The algorithm leverages the strengths of both quantum and classical computing to efficiently search for optimal solutions.

**QHOS Algorithm Overview**

1. **Problem Formulation**: Define the optimization problem as a quadratic unconstrained binary optimization (QUBO) problem, which can be represented as a matrix of coefficients.
2. **Quantum Circuit Preparation**: Prepare a quantum circuit consisting of:
   * A Hadamard gate to create a superposition of all possible solutions.
   * A QAOA circuit to apply the QUBO problem's constraints and objective function.
   * An amplitude amplification circuit to amplify the probability of the optimal solution.
3. **Classical Preprocessing**: Perform classical preprocessing to:
   * Reduce the problem size by applying techniques like dimensionality reduction or feature selection.
   * Identify a good initial solution using classical optimization methods.
4. **Quantum-Classical Iteration**: Iterate between the quantum and classical components:
   * Apply the QAOA circuit to the current solution to generate a new set of candidate solutions.
   * Use classical optimization methods to refine the candidate solutions and select the best one.
   * Apply amplitude amplification to the selected solution to increase its probability.
5. **Solution Refining**: Repeat the quantum-classical iteration until convergence or a satisfactory solution is reached