Seminar: Advanced Topics in Quantum Computing
On efficient encodings for quantum solutions to vehicle routing problems

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Abstract

This report details recent advances in the optimisation of computing resources for quantum approaches to solving the vehicle routing problem (VRP) and its variants. This set of problems is of significant importance with regard to logistical applications in industry. In accordance with the input constraints of the quantum hardware, the problem is formulated as a quadratic unconstrained binary optimisation (QUBO). A simple approach known as the full encoding results in each solution represented by a unique basis state, thereby requiring one qubit per classical variable. Due to this inefficiency in resource allocation when considering the at worst factorial search space, a more optimised minimal encoding is suggested that offers a logarithmic reduction in necessary computing power. In spite of certain drawbacks incurred by employing this minimal encoding, experiments have shown that the solution quality is not heavily impacted.