Fall 2021

Computer Science 5300

Advanced Algorithm Design and Analysis
Group Proposal

1 What style your use, IEEE or MLA?

IEEE

2 Title of the topic

Branch and Bound

3 Group number and full names of all members.

Group #1: Rick Ramirez, Ruben Bramasco, Vikram Sai Kishan Sriram

4 A brief description of the topic

The branch and bound framework has been found to be a useful method of solving combinatorial optimization problems by means of a state space search and has become a commonly used tool for solving NP-hard optimization problems in general. The technique involves forming a set of candidate solutions in the form of a rooted tree. Each branch is explored and checked against an estimated bound on the optimal solution. If the branch does not yield a better solution, it is discarded.

This design paradigm has applications in many areas of physics and economics, and is actively being improved upon. We examine new classical applications of the branch and bound method involving evacuation techniques and calculating the maximum edge-weighted clique problem, as well as explore a quantum adaptation of the technique along with it's application to the ising model.

5 Live or pre-recorded? For your team presentation.

Pre-recorded

6 At least five main references to recent books or technical articles you plan to use

References

[1] Flavio Baccari, Christian Gogolin, Peter Wittek, and Antonio Acín. Verifying the output of quantum optimizers with ground-state energy lower bounds. *Physical Review Research*, 2(4):043163, 2020.

[2] Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, and Clifford Stein. *Introduction to algorithms*. MIT press, 2009.

[3] Marc Goerigk, Bob Grün, and Philipp Heßler. Branch and bound algorithms for the bus evacuation problem. *Computers & Operations Research*, 40(12):3010–3020, 2013.

[4] Ashley Montanaro. Quantum speedup of branch-and-bound algorithms. *Physical Review Research*, 2(1):013056, 2020.

[5] Pablo San Segundo, Stefano Coniglio, Fabio Furini, and Ivana Ljubić. A new branch-and-bound algorithm for the maximum edge-weighted clique problem. *European Journal of Operational Research*, 278(1):76–90, 2019.