1154-90-1022 **Yu Du*** (duyu197@gmail.com), 1475 Lawrence Street, R 5021, Denver, CO 80202. *Quantum Bridge Analytics: A Tutorial on Formulating and Using QUBO Models.*

By its association with the Ising problem in physics, the Quadratic Unconstrained Binary Optimization(QUBO) model has emerged as an underpinning of the quantum computing area known as quantum annealing and has become a subject of study in neuromorphic computing. Computational experience is being amassed by both the classical and the quantum computing communities that highlight not only the potential of the QUBO model but also its effectiveness as an alternative to traditional modeling and solution methodologies. This tutorial discloses the basic features of the QUBO model that give it the power and flexibility to encompass the range of applications that have thrust it onto the center stage of the optimization field. We show how many different types of constraining relationships arising in practice can be embodied within the "unconstrained" QUBO formulation in a very natural manner using penalty functions, yielding exact model representations in contrast to the approximate representations produced by customary uses of penalty functions. We also describe recent innovations for solving QUBO models that offer a fertile avenue for integrating classical and quantum computing and for applying these models in machine learning. (Received September 12, 2019)