

PRACTICAL QUANTUM COMPUTING

OUR MISSION TO UNLOCK THE POWER OF QUANTUM COMPUTING TO BENEFT BUSINESS AND SOCIETY START NG (O) D/AY

BUSINESS-CRITICAL GROCERY TASKS IN MINUTES INSTEAD OF HOURS



save on foods

"What Advantage gives us, is the ability to seamlessly integrate quantum into our business problems. We've been able to decrease the amount of time to get a result from 25 hours down to seconds."

-ANDREW DONAHER, VP DIGITAL & ANALYTICS, SAVE-ON-FOODS

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LOGISTICS OPTIMIZATION AT PORT OF LA WITH QUANTUM COMPUTING



SAVANTX

D-Wave's quantum system is used as part of the SavantX HONE optimization engine at the Port of Los Angeles. The goal is to expedite delivery of containers out of the terminal while increasing the amount of cargo that can be handled.

"With HONE and D-Wave, each huge crane handled 60% more cargo per day, while the turnaround time for trucks was reduced by 12%."

— SAVANTX TEAM

DIWOVC

OPTIMIZING THE RENEWABLE ELECTRIC GRID



E.ON

Explored how D-Wave's quantum hybrid technology can more efficiently manage modern power grids, which have an increasingly diverse and decentralized set of generating facilities.

"The IEEE 118-bus test case shows time performance speed-up. The increment in performance would enable real time planning and operations of electrical grids."

—E.ON TEAM



A QUANTUM SOLUTION FOR INVESTMENT APPLICATIONS





The D-Wave hybrid solver significantly decreased compute time to minimize the capital needed for hedging operations, optimized investment portfolios, and increased a bond portfolio internal rate of return (IRR).

"What normally took the bank several hours of compute time was reduced to just minutes via quantum computing technology – an up to 90% decrease in compute time over the traditional solution."

-CAIXA BANK TEAM

POWERFUL HYBRID SOLVERS

CONSTRAINED QUADRATIC MODEL SOLVER

- Up to 500,000 variables and 100,000 constraints
- Provide separate objective and constraints
- Inequality & equality constraints

BINARY QUADRATIC MODEL SOLVER

- Up to 1,000,000 binary variables
- Full flexibility in problem formulation

DISCRETE QUADRATIC MODEL SOLVER

- Enables optimization with option selection: e.g., Choose one of 11, 19, 29
- Accepts up to 5,000 discrete variables

SOLVERS THAT RUN PROBLEMS ON A COMBINATION OF QUANTUM AND CLASSICAL RESOURCES







CQM WITH CONTINUOUS VARIABLES

EXPANDS HYBRID SOLVER PORTFOLIO

✓ ALLOWS FOR MORE NATIVE REPRESENTATIONS

✓ UNLOCKS LARGER APPLICATION PROBLEMS

FEATURES:

- Binary, integer and real/continuous variables
- Linear and quadratic terms
- Up to 100,000 constraints
- Inequality & equality constraints





3D BIN PACKING



GOAL: Determine the optimal placement and orientation of boxes within containers

CHALLENGES:

- Which container to put each box in?
- Where to place each box in the container?
- What orientation for each box?

This is a challenging, NP-hard problem.

TECHNICAL DESCRIPTION

Objective:

- Stack boxes from the floor upwards
 - Minimize average height
 - Minimize total height
- Minimize number of bins used

Constraints:

- Choose an orientation for each box
- Put each box in a container
 - Assign to one from a list
 - Ensure dimensions are within boundaries
 - Ensure boxes don't overlap
- Place boxes into containers in order