

NAME

qbsolv - minimize the objective function represented by a QUBO

SYNOPSIS

```
qbsolv -i <input_file.qubo> [-o <output_file> [-w]] [-m] [-T  
<target_value>] [-a <algorithm>] [-t <num_seconds>] [-n  
<num_repeats>] [-S <subproblem_size>] [r <seed>] [-v  
<verbosity_level>] [-q] [-V] [-h]
```

DESCRIPTION

qbsolv executes the quadratic unconstrained binary optimization (QUBO) problem in the specified file. It provides bit-vector results that minimize or, optionally, maximize the value of the objective function represented by the QUBO problem. **qbsolv** typically executes in a hybrid fashion on a classical CPU and a quantum processing unit (QPU).

The problem must be in the QUBO(5) file format and is not limited to the size (number of variables), connectivity pattern, or numerical precision of the D-Wave system on which it will be executed.

OPTIONS

-i <input_file.qubo>

Name of the file (relative or absolute pathname) containing the input QUBO. The ".qubo" extension is by convention.

-o <output_file>

Optional. Name of the file (relative or absolute pathname) to which **qbsolv** will write results. If no file is specified, results are written to standard output.

-a algorithm

Optional. Chooses nuances of the outer loop algorithm. The default is 'o' for the original **qbsolv** method, which selects the submatrix based upon change in energy. An alternative is 'p' for path relinking, which selects the submatrix based upon differences of solutions.

-w

Optional, in which case **-o** must also be specified. Prints the input QUBO matrix and the output result in .csv format to the specified output file.

-m

Optional. Specifies that **qbsolv** is to return the maximum value of the objective function instead of the minimum (default).

-T <target_value>

Optional. Target value of the objective function, expressed as an integer or floating-point number. When target value is reached, **qbsolv** stops the optimization process. Usually beneficial to specify only when the optimal value of the objective function has been analytically derived.

-t <num_seconds>

Optional. Number of seconds of elapsed CPU time consumed by the classically executing portion of **qbsolv** after which it stops the optimization process. The value may be specified as an integer or floating-point value. The elapsed CPU time is only checked after completion of the main loop, so the actual stop time may be more than the value. If options **-T** or **-n** are also specified, those limits may (depending on their values) stop **qbsolv** execution before the timeout is reached. The default value is 2,592,000.0 seconds (30 days).

-n <num_repeats>

Optional. Number of times that **qbsolv** is to repeat the main loop of the algorithm after a new optimal value is found. This value must be a positive integer. The default value is 40.

-r <seed>

Optional. Used to set the seed for random number generation.

-S <subproblem_size>

This optional argument indicates the size of the subproblems into which the **QUBO** will be decomposed. A **"-S 0"** argument or **"-S"** argument not present indicates to use the size specified in the embedding file found in the workspace set up by **dw**. If a **dw** environment has not been established, the value will default to (47) and will use the tabu solver for subproblem solutions. If a value is specified, **qbsolv** uses that value to create subproblems and solve with the tabu solver. The ability to establish a **dw**

environment is dependent upon the proper installation of qOp tools on your system.

-v <verbosity_level>

Optional. Level of verbosity of the output. Values are as follows:

- **0** (default) outputs the number of bits in the solution, the solution itself, and the energy of the solution.
- **1** outputs the same information as above for multiple solutions, if found.
- **2** outputs more detailed information at each step of the algorithm.

-q

Optional. Prints the format of an arbitrary QUBO file and exits without running the program.

-v

Optional. Prints the version number of the **qbsolv** program and exits without running the program.

-h

Optional. Prints the help message for **qbsolv** and exits without running the program.

BUGS

Report any bugs to dwsupport@dwavesys.com.

COPYRIGHT

© 2016 D-Wave Systems Inc.

SEE ALSO

qubo(5)