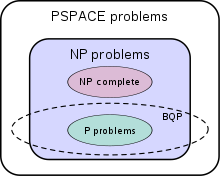
## Quantum relation to classical computational complexity

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P vs NP - Quantum Computing? Is there a link? A quantum complexity class is a collection of computation problems that are solvable by a chosen quantum computational model that obeys certain resource constraints. For example, BQP is the quantum complexity class of all decision problems that can be solved in polynomial time by a quantum computer. BQP stands for “bounded error, quantum, polynomial time”. Quantum computers only run probabilistic algorithms, so BQP on quantum computers is the counterpart of BPP (“bounded error, probabilistic, polynomial time”) on classical computers. It is defined as the set of problems solvable with a polynomial-time algorithm, whose error is bounded away from one half. A quantum computer is stated by some researchers to “solve” a problem if, for every instance, its answer will be right with high probability. If that solution runs in polynomial time, then that problem is in BQP.

When it comes to performance really it just comes down to that quantum computers and algorithms can do most problems quicker at every instance. Even if the size of the problem gets larger and larger I believe quantum methods could far surpass the classical ways, as factoring large 500 digit numbers has come to being easy work for these new machines. When looking for information on this topic it is quite difficult to find conclusive proof for much of the theory, due to the fact that this notion of quantum computing has just recently been discovered. What I have found however is this excerpt about time to complete when talking about search algorithms.

**It is the general case that Quantum computing optimizes Big-O complexity asymptotically on the order of n so on relative terms with the standard Big-O model, Quantum Big-O notation can split the exponent term so that something that would take O(n^2) would take O(nLogn) for example.**

**If there's a quantum speedup for some particular problem, it will be reflected in the order of n. For example, classical search takes O(n) while due to** [**Grover**](https://en.wikipedia.org/wiki/Grover's_algorithm) **speedup, a quantum computer could do it in O(√n).**