QUANTUM COMPUTING

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PURE

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Quantum Computing

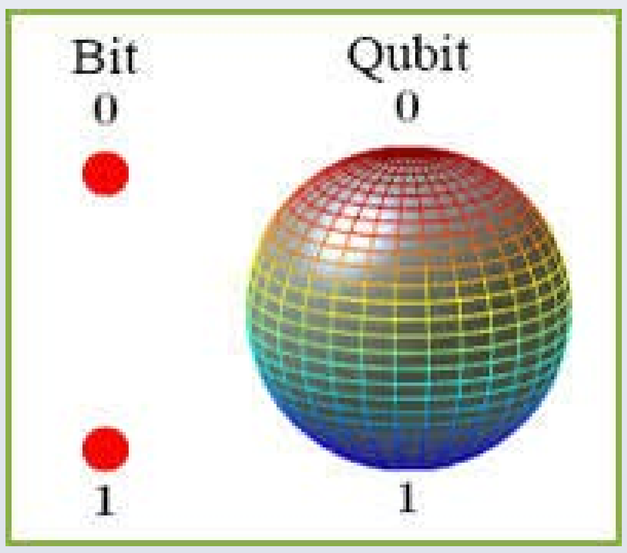
Bits are the simplest present units of information, Measuring a bit results in a one certain value from two possibility (true or false) no matter they are in a classical computer or quantum computer.

We store and process data by using bits in classical computing. There are two possibilities which a bit can exist : 1 and 0. These 1s and 0s are manipulated for particular reasons by logic gates. Then we get a result as a result of this process.

Quantum computers can solve problems much faster than classical ones in the sense that for quantum algorithms the number of operations is much smaller in comparison to their classical counterparts.

Basic terms of quantum computing:

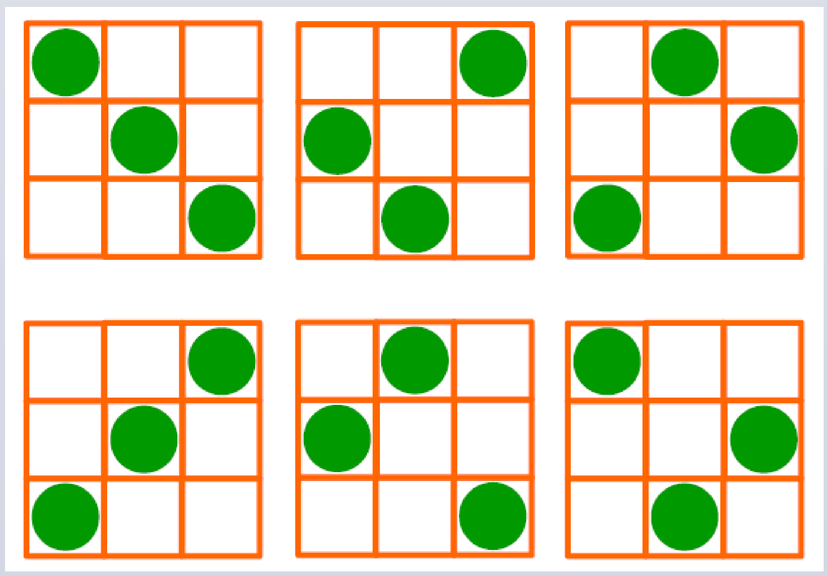
- Qubit
- Superposition
- Entanglement



Gedik's Algorithm

We want to substitute three objects (green circles) in a 3 x 3 square array such that no two circles are in the same row or column.

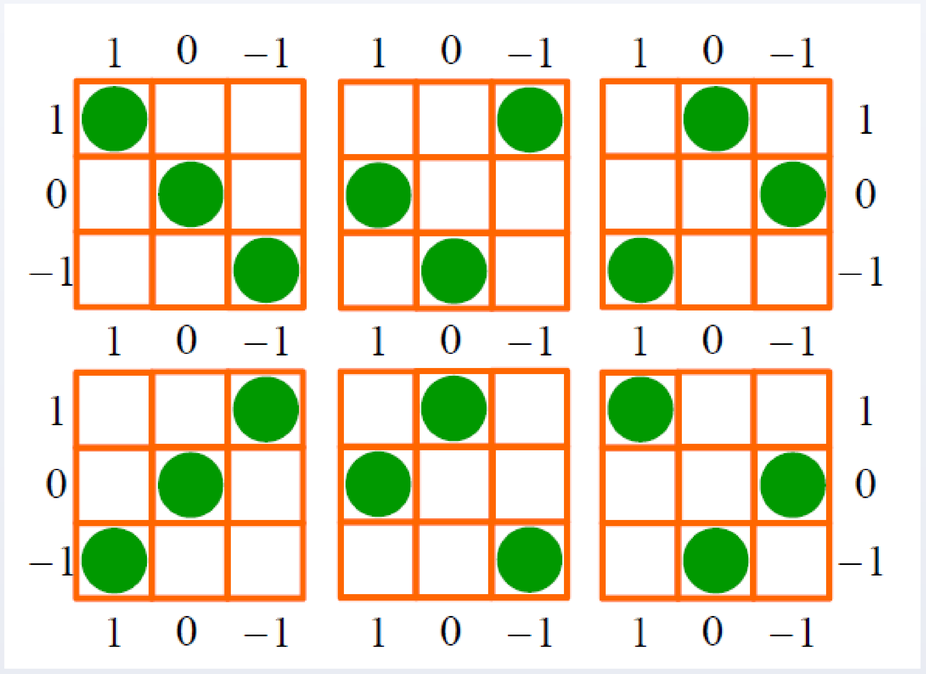
We can do this in 3! = 6 different ways.



It is necessary to know the positions of two ‘s.

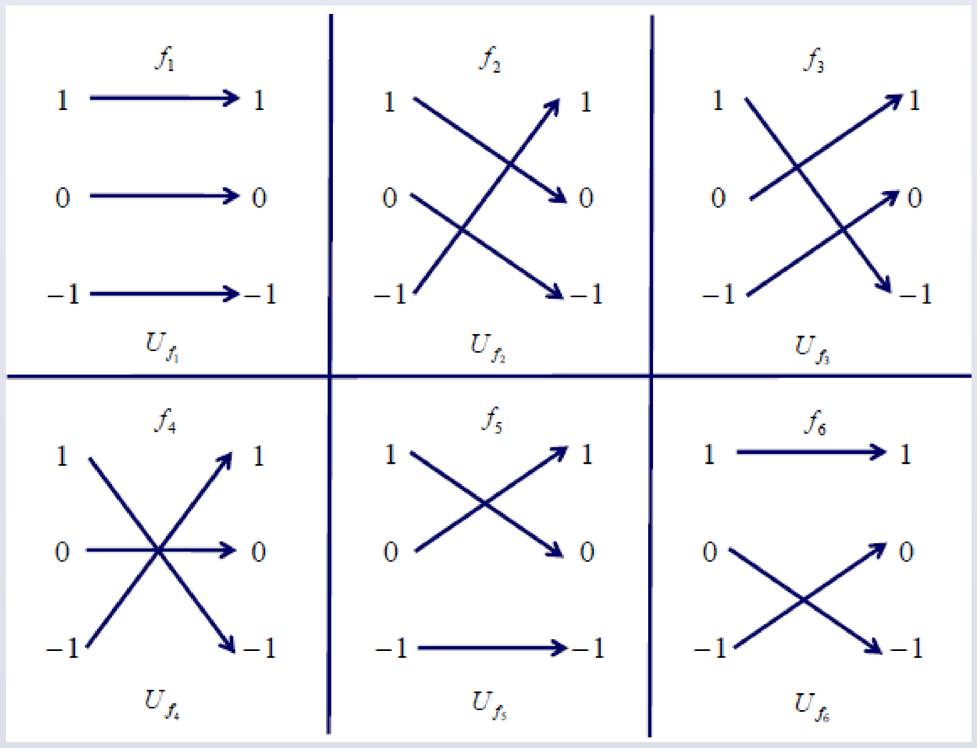
Knowing only one of them is not enough. For example, the leftmost uppermost square is occupied for two different distributions.

Gedik's Algorithm



A three level quantum system (qutrit) is enough to solve this problem with single evaluation.

Upper (lower) row distributions are nothing but even (odd) permutation maps on the set {1,0,-1}.



Permutation operator acting basis states does not provide any improvement over the classical solution.

However, a quantum gate can act on superpositon states.

References

•Zafer Gedik. (n.d.). A simple (probably the simplest) algorithm demonstrating quantum speedup. Retrieved from http://people.sabanciuniv.edu/~gedik/algor.pdf

•SQUIT. (n.d.). Retrieved from http://people.sabanciuniv.edu/~gedik/suquit.htm