Re: Quantum Computation

Source: http://sci.tech−archive.net/Archive/sci.physics.research/2005−04/msg00063.html

- *From*: nmm1@xxxxxxxxxxxx (Nick Maclaren)

- *Date*: Fri, 1 Apr 2005 17:42:10 +0000 (UTC)

In article <d2h75bod1@xxxxxxxxxxxxxxx>,
Ralph Hartley <hartley@xxxxxxxxxxxxxxx> wrote:
>
>Also, note that complexity is a property of *problems*, not algorithms,
>because there is no well defined way to say that two different machines
>are running the same algorithm.

Yes, complexity is a property of problems, in the context of
a particular computational model. But is is ALSO a property of
algorithms (in the same context), which allows you to analyse the
efficiency of them relative to the complexity of the problems.

Your last remark assumes that machines are being treated as black
boxes; this is sometimes the case in complexity analysis, but not
usually. It all comes down to what computational model you choose.

>> To a very good approximation, there is only one
>> practical problem that a quantum computer is known to solve
>> significantly faster than a deterministic one: integer
>> factorisation a.k.a. the discrete logarithm (Shor). Whether
>> there are any other problems that can be is an open question.
>
>That isn't quite true. There is another important class of problems for
>which Quantum Computing is better than classical, and it is a more
>appropriate topic for this list:
>
>Simulating quantum systems.
>
>Given a description of a quantum system, the problem is to answer
>questions about its behavior (Simple questions like "Is the probability
>to go from state A to state B in time t more than 0.5").
>
>You might not consider that a "practical" problem, but I would. I view
>anything that could be used to design a better transistor, or understand
>high temperature superconductivity etc. as practical. Quantum simulation
>wouldn't guarantee a solution to either problem, but it sure would help.

Now, I will dispute that. That is not a practical approach, on its
own. Before you can call it practical, you have to ensure that you

can both set up the required initial state and extract the information you need from the final one. I know of several experts who believe that those processes may be as expensive as the classical approaches.

Note that I am not saying that I think they are, but that they are not known not to be. Actually, this one applies to factorisation as well, to a great extent.

There is also the question of whether each problem will need a new computer built from scratch, or whether there will be a way of programming such state manipulations. Do you, or anyone reading this, have any good references on that?

Regards,
Nick Maclaren.

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- ***Follow−Ups***:
  - ♦ ***Re: Quantum Computation***
    - ◊ *From:* Ralph Hartley

- ***References***:
  - ♦ ***Re: Quantum Computation***
    - ◊ *From:* Ralph Hartley

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