

# Re: Turing machines, quantum computers, and alephs

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Gerry Quinn wrote:

- > *ATM (abstract Turing machine with an infinite tape – what is meant by*
- > *the generic term 'Turing Machine' – an abstract concept that could*
- > *not*
- > *be built in the real world.)*

Common confusion between infinite and unbounded, I'm afraid. The critical information that is missing in the summary description above is that, if one uses the "infinite tape" metaphor (as opposed to the usual "unbounded tape" one), one must also state that the initial state of the "infinite" tape has only finitely many marked cells. (On a two-symbol tape, the initial state has a finite number of 1-bits, for example.)

If an infinite initial marking is allowed, the machine becomes strictly more powerful (rises in the Turing-degree hierarchy). For example, one could solve the Halting Problem for all ordinary Turing machines by table lookup!

Since any accepting computation is finite by definition, if the initial tape has only finitely many marked cells, so do all other states encountered, and hence the same computation could have been carried out with a finite tape. So the two tape metaphors ("infinite" and "unbounded") are equivalent in this case.

(In mathematical logic I believe this is called a "compactness" argument.)

Michel.