Physics 140 – Week of November 12

Reading

For 11/14 – R&P §7.2-7.3.

1. Why apply U_f to $|+\rangle|-\rangle$ instead of $|+\rangle|0\rangle$, as we would have last class?
2. What did you find difficult or confusing about the reading? If nothing was particularly difficult, what was most interesting? Please be as specific as possible.

For 11/16 – R&P §7.4.1-7.4.3

There is some notation here from sections we skipped over. K and T are defined in §5.4.1, and the language for program algorithms is introduced in §6.3.

1. We only have the Deutsch problem to go on, but extrapolating from that example, why do we care so much about phases?
2. What did you find difficult or confusing about the reading? If nothing was particularly difficult, what was most interesting? Please be as specific as possible.

For 11/19 – R&P §7.4.4-7.5.1

1. R&P claim that a classical deterministic algorithm for the Deutsch-Jozsa problem requires $2^{n-1}+1$ queries to the oracle function. Explain.
2. What did you find difficult or confusing about the reading? If nothing was particularly difficult, what was most interesting? Please be as specific as possible.

For 11/26 – R&P §7.5-7.6

1. What did you find difficult or confusing about the reading? If nothing was particularly difficult, what was most interesting? Please be as specific as possible.

Problems

- R&P 7.3
- Deutsch-Jozsa problem: If you allow for a small possibility of error, by making random calls to the oracle function you can greatly improve on the classical deterministic solution, while still falling short of the quantum.

> Design and implement in Python a probabilistic classical algorithm that solves the Deutsch-Jozsa problem with a given certainty. Your program should take as inputs a mystery function $f(x)$ on n bits that is either constant or balanced, and a small number ϵ which is the allowed error. The program should output an answer (i.e., *constant* or *balanced*) and the number of queries made to the oracle function to reduce the margin of error below ϵ. The Python function `random()` (load it by doing: `from random import random`) will generate a pseudo-random number between zero and one that you can use to query $f(x)$ on a random value x.

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As a reminder, reading responses are due in my email inbox (`ekb2@stmarys-ca.edu`) at 9:00 p.m. the night before class. This week the first problem (R&P 7.3) will be due at the usual time, Monday 4:00 p.m., but the coding problem will be due in my email inbox at the end of business Tuesday.