Lab 6 Quantum calculation; Deutch problem; Bernstein-Vazirani problem

Exercise T1 THEORY Quantum calculation
Explain the idea of quantum calculation, explain the definition of Uf gate and its   input and output registers.

Exercise Q1 QUIDE - Deutsch problem
1. Define Deutsch problem for one argument set of four functions
2. Find Uf gates for each function.
   (hint: see fig 2.1 at http://www.lassp.cornell.edu/mermin/qcomp/chap2.pdf)
3. Implement and test Uf functions in the simulator;
4. Implement the solution of the Deutsch problem using quantum gates
   (hint see left part of the fig 2.3
http://www.lassp.cornell.edu/mermin/qcomp/chap2.pdf)
5. Check the result of the solution. What is the gain in comparison to the classical computer? What information is missing?

Exercise Q2 QUIDE - Bernstein-Vazirani problem

1. Explain Bernstein-Vazirani problem
2. Find Uf gate for the problem
   (hint see: fig 2.8 in http://www.lassp.cornell.edu/mermin/qcomp/chap2.pdf)
3. Implement and test Uf gate in the simulator;
4. Implement the solution of the Bernstein-Vazirani problem using quantum gates
   (hint see: fig 2.9 in http://www.lassp.cornell.edu/mermin/qcomp/chap2.pdf)
5. Check the result of the solution. What is the gain in comparison to the classical computer?