Lab 3 Quantum circuilts; Entanglement;

Exercise T1 THEORY
Representation of Qbit on the Bloch Sphere (short introduction). Global phase, qbit phase

Bloch Sphere
https://quantumexperience.ng.bluemix.net/qx/tutorial?sectionId=full-user-guide&page=002-The_Weird_and_Wonderful_World_of_the_Qubit~2F005-The_Bloch_Sphere

Quantum gates as rotations:
https://quantumexperience.ng.bluemix.net/qx/tutorial?sectionId=beginners-guide&page=005-Single-Qubit_Gates~2F006-Summary_of_quantum_gates

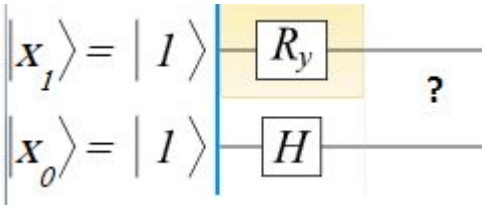
Exercise T2 THEORY

Calculate the results of the following circuits

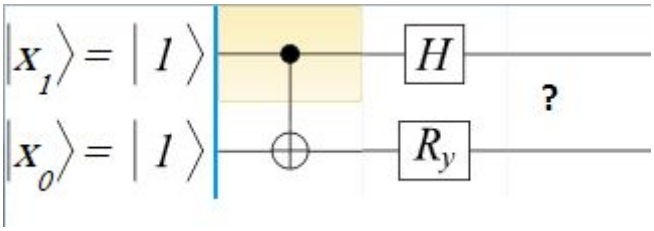
$$R_{y,\varphi}\begin{bmatrix}\cos\frac{\varphi}{2} & -\sin\frac{\varphi}{2}\\ \sin\frac{\varphi}{2} & \cos\frac{\varphi}{2}\end{bmatrix}.$$

$$\varphi=\frac{\pi}{3},\cos\frac{\pi}{6}=\frac{\sqrt{3}}{2}$$

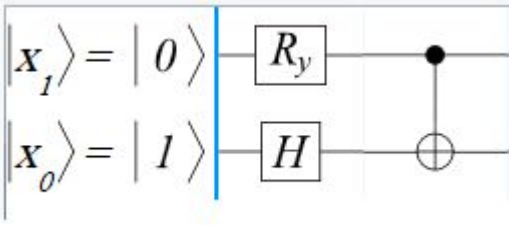
a)



b)



c)



Exercise T3 THEORY

Entangled state

1. Calculate tensor product of two arbitrary qbits states
2. Write the most general state of 2-qbit register
3. Compare both results. Is general state of 2-qbit register always a tensor product of two 1-qbit states? What condition has to be fulfilled?

Exercise Q1 QUIDE

Simulate circuits from exercise T2. Check results with your calculations.

Exercise Q2 QUIDE

Find and test the quantum circuit producing an entangled state, starting from the register in initial state | 00>. Show its behaviour in the simulator. Compare the state of the one qbit from the pair obtained after the measurement of the other qbit. Does it depend on the output of the measurement ?