Lab 3 - Simple Quantum circuits; entangled state

Bloch Sphere demo:
http://demonstrations.wolfram.com/QubitsOnThePoincareBlochSphere/

Quantum gates as rotations:
http://demonstrations.wolfram.com/SingleQubitQuantumGatesOnABlochSphere/

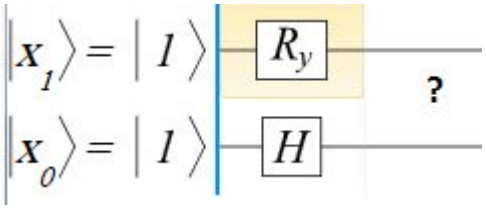
Exercise 1

Calculate the results of the following circuits and check it with the simulator

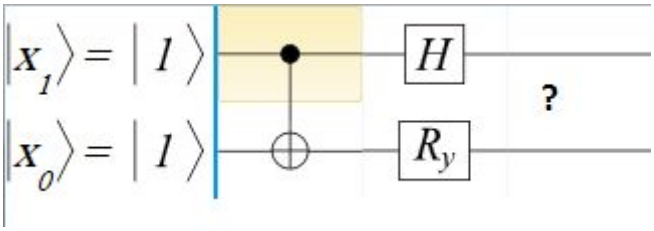
$$R_{y,\varphi}\begin{bmatrix}\cos\frac{\varphi}{2} & -\sin\frac{\varphi}{2}\\ \sin\frac{\varphi}{2} & \cos\frac{\varphi}{2}\end{bmatrix}.$$

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

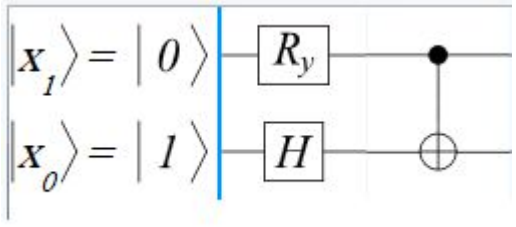
a)



b)



c)



Exercise 2

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 3

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 ?