QWorld Global QBronze Workshop | Homework Day 3

Total points 20/20 ?

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Questions

✓ Suppose you have a circuit with 3 qubits. What happens when you apply   2/2
   H to only first qubit?

- ☑ We obtain the state $1/\sqrt{2}$ (|100⟩ + |000⟩)   ✓
- ☐ We obtain an equal superposition of eight states
- ☐ This is not possible.
- ☑ Others are not changed, as if I is applied to them.   ✓
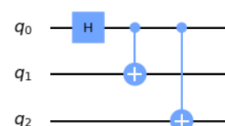- ☐ H is applied to others as well.

✓ What should be the dimension of a vector representing a quantum   1/1
   system with 3 qubits?

- ○ 3
- ◉ 8   ✓
- ○ 9
- ○ 1

✓ What is the result of CNOT($1/\sqrt{2}$ (|10⟩ + |11⟩)) if the first qubit is the control   2/2
   and second qubit is the target? (|first qubit, second qubit ⟩)

- ○ |11⟩
- ○ |01⟩
- ○ $1/\sqrt{2}$ (|01⟩ + |10⟩)
- ◉ $1/\sqrt{2}$ (|10⟩ + |11⟩)   ✓

✓ What can be the outcome if the following circuit is measured and   4/4
   simulated for 1000 times?

○ {'001': 490, '000': 502}

○ {'000': 247, '001': 253, '010': 255, '111': 245}

● {'000': 480, '111': 520} ✓

○ {'100': 501, '000': 499}

Code

```
qc = QuantumCircuit(2)

#Your code here
```

✓ We have a circuit with two qubits created with the code given above.   2/2
What should come to #Your code here if we want to obtain the state 1/√2
(|00) + |10))? (Follow Qiskit's ordering of qubits)

qc.h(1) ✓

✓ Mark the true statements.   2/2

☑ It is possible to apply a NOT gate to a target qubit depending on whether some   ✓
qubit is in state 0.

☐ We can check the value of a qubit by the statement if(q[0]==1)

☑ It is possible to apply a NOT operator controlled by two qubits at the same time.   ✓

☐ Unitary simulator returns you the current state vector

Code

```
q2 = QuantumRegister(2,"qreg")
c2 = ClassicalRegister(2,"creg")
qc2 = QuantumCircuit(q2,c2)

qc2.h(q2[0])
qc2.cx(q2[0],q2[1])
#Your code here

qc2.measure(q2,c2)
job = execute(qc2,Aer.get_backend('qasm_simulator'),shots=1000)
counts = job.result().get_counts(qc2)
print(counts) # counts is a dictionary
```

✓ If the output of the above code is {'01': 500, '10': 500}, what should you   3/3
write to #Your code here ?

qc2.x(q2[0]) ✓

Code

```
def mystery(qc,q):

    qc.x(q[a])

    qc.ccx(q[b],q[c],q[d])

    qc.x(q[e])
```

✓ in the code above a,b,c,d,e are integers. mystery function takes a circuit   4/4
and a register with 3 qubits as input and applies a NOT gate to the third
qubit if the second qubit is in state |1) and first qubit is in state |0). What
will be the values of a,b,c,d,e? (Follow Qiskit's order: q[2] is the first qubit,
q[1] is the second, q[0] is the third and write your answer separated by
commas in the order a,b,c,d,e without leaving space e.g. 1,3,0,2,1)

2,2,1,0,2 ✓