



Professional
Certification
Program

Exam C1000 – 112 IBM Certified Associate Developer - Qiskit v0.2X

1. Which statement will create a quantum circuit with four quantum bits and four classical bits?

- A. `QuantumCircuit(4, 4)`
- B. `QuantumCircuit(4)`
- C. `QuantumCircuit(QuantumRegister(4, 'qr0'),
QuantumRegister(4, 'cr1'))`
- D. `QuantumCircuit([4, 4])`

2. Given this code fragment, what is the probability that a measurement would result in $|0\rangle$?

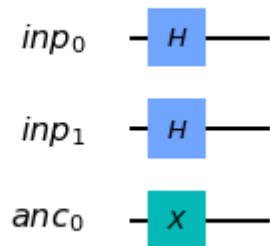
```
qc = QuantumCircuit(1)
qc.ry(3 * math.pi/4, 0)
```

- A. 0.8536
- B. 0.5
- C. 0.1464
- D. 1.0

3. Assuming the fragment below, which three code fragments would produce the circuit illustrated?

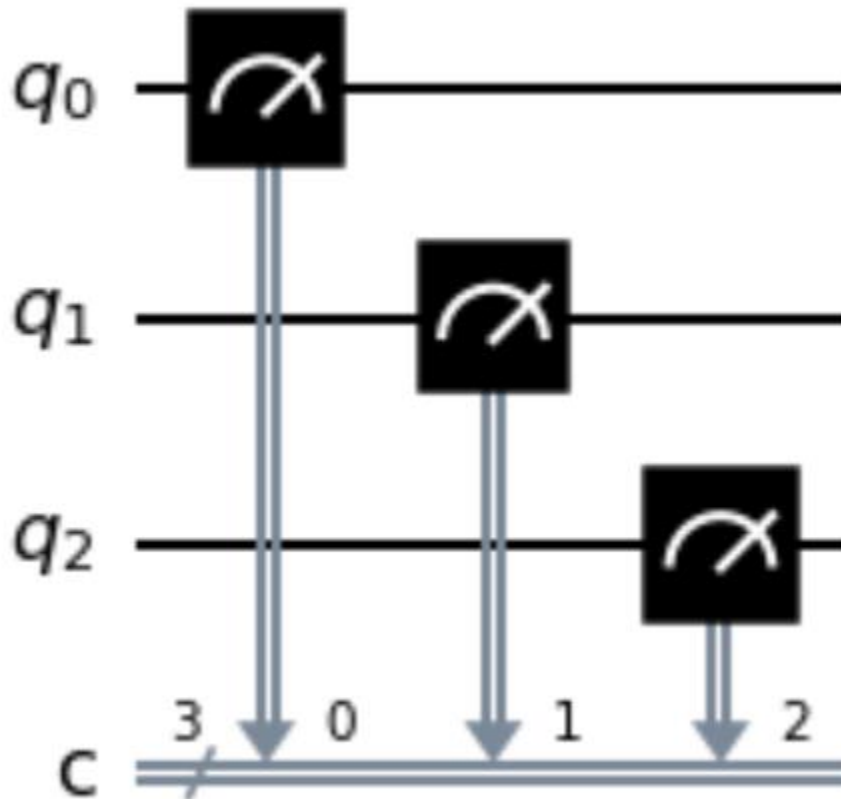
```
inp_reg = QuantumRegister(2, name='inp')
ancilla = QuantumRegister(1, name='anc')
qc = QuantumCircuit(inp_reg, ancilla)
```

```
# Insert code here
```



- A. `qc.h(inp_reg)`
`qc.x(ancilla)`
`qc.draw()`
- B. `qc.h(inp_reg[0:2])`
`qc.x(ancilla[0])`
`qc.draw()`
- C. `qc.h(inp_reg[0:1])`
`qc.x(ancilla[0])`
`qc.draw()`
- D. `qc.h(inp_reg[0])`
`qc.h(inp_reg[1])`
`qc.x(ancilla[0])`
`qc.draw()`
- E. `qc.h(inp_reg[1])`
`qc.h(inp_reg[2])`
`qc.x(ancilla[1])`
`qc.draw()`
- F. `qc.h(inp_reg)`
`qc.h(inp_reg)`
`qc.x(ancilla)`
`qc.draw()`

4. Given an empty QuantumCircuit object, qc, with three qubits and three classical bits, which one of these code fragments would create this circuit?



- A. `qc.measure([0,1,2], [0,1,2])`
- B. `qc.measure([0,0], [1,1], [2,2])`
- C. `qc.measure_all()`
- D. `qc.measure(0,1,2)`

5. Which code fragment will produce a maximally entangled, or Bell, state?

A. `bell = QuantumCircuit(2)`
`bell.h(0)`
`bell.x(1)`
`bell.cx(0, 1)`

B. `bell = QuantumCircuit(2)`
`bell.cx(0, 1)`
`bell.h(0)`
`bell.x(1)`

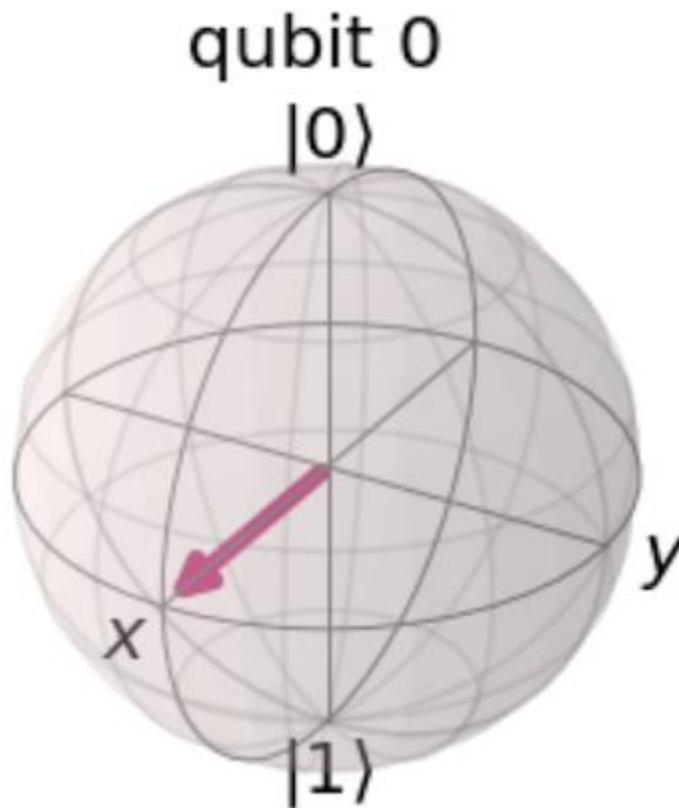
C. `bell = QuantumCircuit(2)`
`bell.h(0)`
`bell.x(1)`
`bell.cz(0, 1)`

D. `bell = QuantumCircuit(2)`
`bell.h(0)`
`bell.h(0)`

6. Given this code, which two inserted code fragments result in the state vector represented by this Bloch sphere?

```
qc = QuantumCircuit(1,1)
# Insert code fragment here

simulator = Aer.get_backend('statevector_simulator')
job = execute(qc, simulator)
result = job.result()
outputstate = result.get_statevector(qc)
plot_bloch_multivector(outputstate)
```



- A. `qc.h(0)`
- B. `qc.rx(math.pi / 2, 0)`
- C. `qc.ry(math.pi / 2, 0)`
- D. `qc.rx(math.pi / 2, 0)`
- `qc.rz(-math.pi / 2, 0)`
- E. `qc.ry(math.pi, 0)`

7. S-gate is a Qiskit phase gate with what value of the phase parameter?

- A. $\pi/4$
- B. $\pi/2$
- C. $\pi/8$
- D. π

8. Which two code fragments, when inserted into the code below, will produce the statevector shown in the output?

```
from qiskit import QuantumCircuit, Aer, execute
from math import sqrt

qc = QuantumCircuit(2)

# Insert fragment here

simulator = Aer.get_backend('statevector_simulator')
result = execute(qc, simulator).result()
statevector = result.get_statevector()
print(statevector)
```

Output:

```
[0.707+0.j  0.+0.j  0.+0.j  0.707+0.j]
```

- A. `v = [1/sqrt(2), 0, 0, 1/sqrt(2)]`
`qc.initialize(v, [0,1])`
- B. `qc.h(0)`
`qc.cx(0,1)`
- C. `v1, v2 = [1,0], [0,1]`
`qc.initialize(v1,0)`
`qc.initialize(v2,1)`
- D. `qc.cx(0,1)`
`qc.measure_all()`
- E. `qc.h(0)`
`qc.h(1)`
`qc.measure_all()`

9. Which code fragment will produce a multi-qubit gate other than a CNOT ?

- A. `qc.cx(0,1)`
- B. `qc.cnot(0,1)`
- C. `qc.mct([0],1)`
- D. `qc.cz(0,1)`

10. Which code fragment will produce a multi-qubit gate other than a Toffoli?

- A. `qc.ccx(0,1,2)`
- B. `qc.mct([0,1], 2)`
- C.

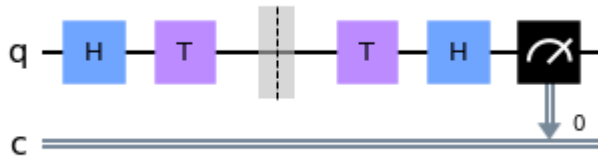
```
from qiskit.circuit.library import CXGate
ccx = CXGate().control()
qc.append(ccx, [0,1,2])
```
- D. `qc.cry(0,1,2)`

11. Which two options would place a barrier across all qubits to the QuantumCircuit below?

```
qc = QuantumCircuit(3,3)
```

- A. `qc.barrier(qc)`
- B. `qc.barrier([0,1,2])`
- C. `qc.barrier()`
- D. `qc.barrier(3)`
- E. `qc.barrier_all()`

12. What code fragment codes the equivalent circuit if you remove the barrier in the following QuantumCircuit?



- A. `qc = QuantumCircuit(1,1)`
`qc.h(0)`
`qc.s(0)`
`qc.h(0)`
`qc.measure(0,0)`
- B. `qc = QuantumCircuit(1,1)`
`qc.measure(0,0)`
- C. `qc = QuantumCircuit(1,1)`
`qc.h(0)`
`qc.t(0)`
`qc.tdg(0)`
`qc.h(0)`
`qc.measure(0,0)`
- D. `qc = QuantumCircuit(1,1)`
`qc.h(0)`
`qc.z(0)`
`qc.h(0)`
`qc.measure(0,0)`

13. Given the following code, what is the depth of the circuit?

```
qc = QuantumCircuit(2, 2)
```

```
qc.h(0)
```

```
qc.barrier(0)
```

```
qc.cx(0,1)
```

```
qc.barrier([0,1])
```

A. 2

B. 3

C. 4

D. 5

14. Which code snippet would execute a circuit given these parameters?

- 1) • Measure the circuit 1024 times,
- 2) • use the QASM simulator,
- 3) • and use a coupling map that connects three qubits linearly

```
qc = QuantumCircuit(3)
```

```
# Insert code fragment here  
result = job.result()
```

A. `qasm_sim = Aer.get_backend('qasm_simulator')`
`couple_map = [[0, 1], [1, 2]]`
`job = execute(qc, backend=qasm_sim, shots=1024,`
`coupling_map=couple_map)`

B. `qasm_sim = Aer.get_backend('ibmq_simulator')`
`couple_map = [[0, 1], [0, 2]]`
`job = execute(qc, loop=1024, coupling_map=couple_map)`

C. `qasm_sim = Aer.get_backend('qasm_simulator')`
`couple_map = [[0, 1], [1, 2]]`
`job = execute(qc, backend=qasm_sim, repeat=1024,`
`coupling_map=couple_map)`

D. `qasm_sim = Aer.get_backend('qasm_simulator')`
`couple_map = [[0, 1], [1, 2]]`
`job = execute(backend=qasm_sim, qc, shot=1024,`
`coupling_map=couple_map)`

15. Which of these would execute a circuit on a set of qubits which are coupled in a custom way?

```
from qiskit import QuantumCircuit, execute, BasicAer
backend = BasicAer.get_backend('qasm_simulator')
qc = QuantumCircuit(3)
```

```
# insert code here
```

- A. `execute(qc, backend, shots=1024, coupling_map=[[0,1], [1,2]])`
- B. `execute(qc, backend, shots=1024, custom_topology=[[0,1], [2,3]])`
- C. `execute(qc, backend, shots=1024, device="qasm_simulator", mode="custom")`
- D. `execute(qc, backend, mode="custom")`

16. Which three simulators are available in BasicAer?

- A. `qasm_simulator`
- B. `basic_qasm_simulator`
- C. `statevector_simulator`
- D. `unitary_simulator`
- E. `quantum_simulator`
- F. `quantum_circuit_simulator`

17. Which line of code would assign a statevector simulator object to the variable `backend` ?

- A. `backend = BasicAer.StatevectorSimulatorPy()`
- B. `backend = BasicAer.get_backend('statevector_simulator')`
- C. `backend = BasicAer.StatevectorSimulatorPy().name()`
- D. `backend = BasicAer.get_back('statevector_simulator')`

18. Which code fragment would yield an operator that represents a single-qubit X gate?

- A. `op = Operator.Xop(0)`
- B. `op = Operator([[0, 1]])`
- C. `qc = QuantumCircuit(1)`
`qc.x(0)`
`op = Operator(qc)`
- D. `op = Operator([[1, 0, 0, 1]])`

19. What would be the fidelity result(s) for these two operators, which differ only by global phase?

```
op_a = Operator(XGate())  
op_b = numpy.exp(1j * 0.5) * Operator(XGate())
```

- A. `state_fidelity()` of 1.0
- B. `state_fidelity()` and `average_gate_fidelity()` of 1.0
- C. `average_gate_fidelity()` and `process_fidelity()` of 1.0
- D. `state_fidelity()`, `average_gate_fidelity()` and `process_fidelity()` of 1.0

20. Given this code fragment, which output fits most closely with the measurement probability distribution?

```
qc = QuantumCircuit(2, 2)  
qc.x(0)  
qc.measure([0,1], [0,1])  
simulator = Aer.get_backend('qasm_simulator')  
result = execute(qc, simulator, shots=1000).result()  
counts = result.get_counts(qc)  
print(counts)
```

- A. {'00': 1000}
- B. {'01': 1000}
- C. {'10': 1000}
- D. {'11': 1000}

Answer Key:

- 1) A
- 2) C
- 3) A,B,D
- 4) A
- 5) A
- 6) A,C
- 7) B
- 8) A,B
- 9) D
- 10) D
- 11) B,C
- 12) A
- 13) A
- 14) A
- 15) A
- 16) A,C,D
- 17) B
- 18) C
- 19) C
- 20) B