Homework 2

Due May 18 at 11:59pm **Points** 20 **Questions** 9
Available May 16 at 9:30pm - May 19 at 11:59pm 3 days **Time Limit** None
Allowed Attempts Unlimited

Take the Quiz Again

Attempt History

	Attempt	Time	Score
KEPT	Attempt 3	3 minutes	17 out of 20
LATEST	Attempt 3	3 minutes	17 out of 20
	Attempt 2	13 minutes	16.33 out of 20
	Attempt 1	2 minutes	2 out of 20

Correct answers are hidden.

Score for this attempt: **17** out of 20
Submitted May 19 at 8:29pm
This attempt took 3 minutes.

Question 1

2 / 2 pts

[**Q28-01**] Which of the following vectors are valid quantum states.

- $\left(\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}\right)$
- $\left(\frac{1}{2}, -\frac{1}{2}, -\frac{1}{2}, \frac{1}{2}\right)$
- $\left(\frac{2}{3}, \frac{1}{3}, \frac{2}{3}, 0\right)$
- $\left(\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, 0, 0\right)$
- $\left(\frac{1}{2}, 0, \frac{1}{2}, 0\right)$

- [ ] $\left(\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}\right)$

Question 2

2 / 2 pts

[**Q28-02**] Which of the following vectors are *not* valid quantum states.

- [x] $\left(\frac{1}{2}, 0, \frac{1}{2}, 0\right)$
- [x] $\left(\frac{1}{4}, -\frac{1}{4}, -\frac{1}{4}, \frac{1}{4}\right)$
- [x] $\left(\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}\right)$
- [ ] $(0, -1, 0, 0)$
- [ ] $\left(\frac{2}{3}, -\frac{1}{3}, \frac{2}{3}, 0\right)$
- [ ] $\left(\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, 0, 0\right)$

Question 3

2 / 2 pts

[**Q32-01**] If the angle of a real valued qubit is x, what is the probability of observing state $|0\rangle$?

- (•) $\cos^2(x)$
- ( ) $\cos(x)$
- ( ) $\sin(x)$
- ( ) $\sin^2(x)$

$\cos(x) + \sin(x)$

Question 4

2 / 2 pts

[**Q12-01**] We have a circuit with a single qubit created with the code given below. What should replace "#Your code here" if we want to apply a NOT operator to the qubit?

```
q =  QuantumRegister(1)
c = ClassicalRegister(1)
qc = QuantumCircuit(q,c)

#Your code here

qc.measure(q[0],c[0])
job = execute(qc,Aer.get_backend('qasm_simulator'),shots=1024)
counts = job.result().get_counts(qc)
print(counts) # counts is a dictionary
```

qc.x(q[0])

Question 5

2 / 2 pts

[**Q12-02**] What will be the output of the code shown below?

```
q =  QuantumRegister(1)
c = ClassicalRegister(1)
qc = QuantumCircuit(q,c)

qc.x(q[0])

qc.measure(q[0],c[0])
job = execute(qc,Aer.get_backend('qasm_simulator'),shots=1024)
counts = job.result().get_counts(qc)
print(counts) # counts is a dictionary
```

- {'1': 1024}
- {'0': 1024}
- {'1': 502, '0': 522}

- {'11': 1024}

Question 6

2 / 2 pts

[P20-01} In the quantum coin flipping experiment, what happens when a photon is send through the beam splitter?

- (•) It is reflected with probability 1/2 and transmitted with probability 1/2.
- ( ) It is reflected with probability 1.
- ( ) It is transmitted with probability 1.
- ( ) It is reflected with probability 1/4 and transmitted with probability 3/4.

Question 7

3 / 3 pts

[**Q36-01**] In the following code, what should replace "#Your code here", if we want to create the quantum state $\frac{1}{\sqrt{2}}(|0\rangle - |1\rangle)$?

(Hint: Think about the vector representation of this state to start with if you are stuck)

```
q2 = QuantumRegister(1,"qreg")
c2 = ClassicalRegister(1,"creg")
qc2 = QuantumCircuit(q2,c2)

qc2.x(q2[0])
#Your code here

qc2.measure(q2,c2)
job = execute(qc2,Aer.get_backend('qasm_simulator'),shots=100)
counts = job.result().get_counts(qc2)
print(counts) # counts is a dictionary
```

qc2.h(q2[0])

Unanswered

Question 8

0 / 3 pts

[CS12-01] You are given the following probabilistic operator :

$$\begin{pmatrix} 0.2 & 0.4 \\ 0.8 & 0.6 \end{pmatrix}$$

Suppose that we represent the weather being sunny with state 0 and rainy with state 1. The transition probabilities can be interpreted as follows:

- If today is sunny, the probability that tomorrow is sunny is 0.2

- If today is sunny, the probability that tomorrow is rainy is 0.8

- If today is rainy, the probability that tomorrow is sunny is 0.4

- If today is rainy, the probability that tomorrow is rainy is 0.6

Given that it is sunny on Monday, what is the probability that it will be rainy on Wednesday?

(Write the probability as a decimal number e.g. 0.3)

Question 9

2 / 2 pts

[**Q12-03**] What will be the output of the following code?

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

qc2.x(q2[0])

qc2.measure(q2,c2)
job = execute(qc2,Aer.get_backend('qasm_simulator'),shots=100)
counts = job.result().get_counts(qc2)
print(counts) # counts is a dictionary
```

- {'01': 100}

- {'10': 100}
- {'11': 100}
- {'10': 1024}

Quiz Score: **17** out of 20