QClass24/25 Quiz2

Due Nov 11 at 3:59am **Points** 20 **Questions** 10
Available until Nov 11 at 3:59am **Time Limit** 60 Minutes
Allowed Attempts 2

Take the Quiz Again

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	58 minutes	8 out of 20

Last Attempt Details:

Time:	58 minutes
Current Score:	8 out of 20
Kept Score:	8 out of 20

1 More Attempt available

Take the Quiz Again

(Will keep the highest of all your scores)

Correct answers are hidden.

Score for this attempt: **8** out of 20
Submitted Nov 10 at 6:47pm
This attempt took 58 minutes.

Question 1

2 / 2 pts

If $x = \frac{1}{4}$, which one of the following vectors can be a valid quantum state?

- $\begin{pmatrix} -x \\ 0 \\ x \\ 2x \end{pmatrix}$
- $\begin{pmatrix} -x \\ 0 \\ 0 \\ 2x \end{pmatrix}$
- $\begin{pmatrix} -x \\ -3x-1 \\ 0 \\ 2x \end{pmatrix}$
- $\begin{pmatrix} -\sqrt{3}x \\ -3x \\ 0 \\ 2x \end{pmatrix}$

Question 2

2 / 2 pts

```
Set a qubit to state |1⟩
Measure the qubit
Apply H gate
Apply X gate
Apply H gate
Measure the qubit
```

If we execute the above program, 1000 times, what is the expected value of observing '0'?

- 500
- 0
- 250
- 1000

Incorrect

Question 3

0 / 2 pts

What is $XXXHHHXXHHH$?

- $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$
- $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$
- $\begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{pmatrix}$
- $\begin{pmatrix} \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{pmatrix}$

Incorrect

Question 4

0 / 2 pts

When a qubit is in the quantum state $|u\rangle = \begin{pmatrix} -\sqrt{\frac{2}{3}} \\ \frac{1}{\sqrt{3}} \end{pmatrix}$,

We apply the operators X, H and then X.

What is the probability of being in state $|0\rangle$?

- 0.9714
- 0.0286
- 0.9
- 0.2

Incorrect

Incorrect

Question 5

0 / 2 pts

We have 1000 copies of the same qubit in state $|u\rangle \in \mathbb{R}^2$ corresponding to a vector on the unit circle with angle $\frac{35\pi}{50}$.

If we measure all copies, which one of the following outcomes is more likely compared to the other?

- {'0': 450, '1': 550}
- {'0': 350, '1': 650}
- {'0': 250, '1': 750}
- {'0': 150, '1': 850}

Incorrect

Question 6

0 / 2 pts

```
Repeat 100 times:
    Set a qubit to state |1⟩
    Apply rotation R(7π/11)   five times
    Measure the qubit
```

Which one of the following outcomes is more likely compared to the others?

- {'0': 30, '1': 70}
- {'0': 10, '1': 90}
- {'0': 40, '1': 60}
- {'0': 20, '1': 80}

Question 7

2 / 2 pts

We have a single qubit.

```
Repeat four times:
Randomly pick θ ∈ (0, π/2)
    Repeat 250 times:
        set the qubit to state |0⟩
        apply X with probability 1/2
        apply rotation R(θ)
        measure the qubit
```

Which one of the following outcomes is more likely compared to the other?

Hint: You may also solve the problem analytically.

- {'0': 255, '1': 745}
- {'0': 988, '1':12}
- {'0': 765, '1': 235}

{'0': 487, '1': 513}

Question 8

2 / 2 pts

```
Set a qubit to state |0⟩
Repeat 4 times:
    Apply rotation R(π/4)
    Apply reflection Ref(π/4)
```

What is the final state?

- $|+\rangle$
- $|1\rangle$
- $|0\rangle$
- $|-\rangle$

Incorrect

Question 9

0 / 2 pts

We have 2000 copies of the identical qubit in state $\begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix}$, where $\theta \in (0, \pi)$.

We do the experiments below in order to guess the value of θ.

1) We measure 1000 copies, observe $|0\rangle$ 67 times, and state $|1\rangle$ 933 times.

2) Then, we apply Hadamard to each of the remaining 1000 copies. After that, we measure these remaining copies and observe $|0\rangle$ 750 times and $|1\rangle$ 250 times.

Which one of the following is the value of θ (in degrees) more likely compared to the others?

- 75
- 15
- 105
- 165

Incorrect

Question 10

0 / 2 pts

We have two scenarios:

A) Set a qubit to $|0\rangle$
Apply reflection $Ref\left(\frac{\pi}{3}\right)$ and then reflection $Ref\left(\frac{\pi}{4}\right)$

B) Set a qubit to $|0\rangle$
Apply reflection $Ref\left(\frac{\pi}{4}\right)$ and then reflection $Ref\left(\frac{\pi}{3}\right)$

Let $|v_A\rangle$ and $|v_B\rangle$ be the final states of Scenarios A and B, respectively.

What is the angle between $|v_A\rangle$ and $|v_B\rangle$?

- 0
- $\frac{2\pi}{3}$
- $\frac{5\pi}{3}$
- $\frac{\pi}{2}$

Quiz Score: **8** out of 20

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