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QClass24/25 Quiz1

Due Oct 21 at 2:59am   **Points** 20   **Questions** 10
Available until Oct 21 at 2:59am   **Time Limit** 60 Minutes
Allowed Attempts 2

[Take the Quiz Again]

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	12 minutes	12 out of 20

⚠ **Correct answers are hidden.**

Score for this attempt: **12** out of 20
Submitted Oct 7 at 10:29pm
This attempt took 12 minutes.

Last Attempt Details:

Time: 12 minutes

Current Score: 12 out of 20

Kept Score: 12 out of 20

1 More Attempt available

Take the Quiz Again

(Will keep the highest of all your scores)

Question 1	2 / 2 pts

Let $v = \begin{pmatrix} 2 \\ 1 \\ 2 \end{pmatrix}$ be a vector. If we normalize the vector v then the new normalized vector is represented as follows.

○ $v = \begin{pmatrix} \frac{2}{3} \\ \frac{1}{3} \\ \frac{1}{3} \end{pmatrix}$

◉ $v = \begin{pmatrix} \frac{2}{3} \\ \frac{1}{3} \\ \frac{2}{3} \end{pmatrix}$

○ $v = \begin{pmatrix} \frac{1}{3} \\ \frac{1}{3} \\ \frac{2}{3} \end{pmatrix}$

○ $v = \begin{pmatrix} \frac{1}{3} \\ \frac{1}{3} \\ \frac{1}{3} \end{pmatrix}$

Question 2

Find $A \otimes B$ where the matrices A and B are given as follows.

$$A = \begin{pmatrix} 0 & 2 \\ 1 & 0 \end{pmatrix} \quad B = \begin{pmatrix} 1 & i \\ i & -1 \end{pmatrix}$$

○ $\begin{pmatrix} 0 & 0 & 2 & 2i \\ 0 & 0 & 2i & -2 \\ 1 & i & 0 & 0 \\ i & -1 & 0 & 0 \end{pmatrix}$

○ $\begin{pmatrix} 0 & -2 & 0 & -2i \\ -1 & 0 & -i & 0 \\ 0 & -2i & 0 & 2 \\ -i & 0 & 1 & 0 \end{pmatrix}$

○ $\begin{pmatrix} 0 & -2 & 0 & -2i \\ -1 & 0 & -i & 0 \\ 0 & -2i & 0 & 2 \\ -i & 0 & 1 & 0 \end{pmatrix}$

○ $\begin{pmatrix} 0 & 0 & -2 & -2i \\ 0 & 0 & -2i & 2 \\ -1 & -i & 0 & 0 \\ -i & 1 & 0 & 0 \end{pmatrix}$

◉ $\begin{pmatrix} 0 & 2 & 0 & 2i \\ 1 & 0 & i & 0 \\ 0 & 2i & 0 & -2 \\ i & 0 & -1 & 0 \end{pmatrix}$

Question 3

We have a composite system with two probabilistic bits. Let $v = \frac{2}{3}\lceil 10 \rfloor + \frac{1}{3}\lceil 11 \rfloor$ be its probabilistic state. Which one of the following represents this state?

○ $\begin{pmatrix} 0 \\ 0 \\ \frac{2}{3} \end{pmatrix}$

○ $\begin{pmatrix} \frac{2}{3} \\ \frac{1}{3} \\ 0 \\ 0 \end{pmatrix}$

◉ $\begin{pmatrix} 0 \\ \frac{2}{3} \\ 0 \\ 0 \end{pmatrix}$

$$\begin{pmatrix} \frac{1}{3} \end{pmatrix}$$

○ $$\begin{pmatrix} 0 \\ \frac{2}{3} \\ \frac{1}{3} \\ 0 \end{pmatrix}$$

Question 4   2 / 2 pts

A probabilistic bit is in the state of $v = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$. We apply the

probabilistic operator $M = \begin{pmatrix} \frac{1}{5} & \frac{1}{2} \\ \frac{4}{5} & \frac{1}{2} \end{pmatrix}$ three times on v and

obtain the probabilistic state u. What is the vector representation of u?

○ $u = \begin{pmatrix} \frac{1}{5} \\ \frac{4}{5} \end{pmatrix}$

◉ $u = \begin{pmatrix} \frac{46}{125} \\ \frac{79}{125} \end{pmatrix}$

○ $u = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$

○ $u = \begin{pmatrix} \frac{11}{25} \\ \frac{14}{25} \\ \frac{?}{25} \end{pmatrix}$

Incorrect   **Question 5**   0 / 2 pts

If the following matrix is unitary, then what is the value of a ?

$$U = \begin{pmatrix} -\frac{2}{\sqrt{5}} & \frac{i}{\sqrt{5}} \\ a & \frac{2}{\sqrt{5}} \\ a & \frac{2}{\sqrt{5}} \end{pmatrix}$$

◉ $\frac{i}{\sqrt{5}}$

○ $-\frac{2}{\sqrt{5}}$

○ $\dfrac{2}{\sqrt{5}}$

○ $-\dfrac{i}{\sqrt{5}}$

Question 6
2 / 2 pts

The probabilistic state of a composite system with 4 bits is represented by a vector with 16 entries. Which entry represents the state $\lceil 1010 \rfloor$?

○ 12

○ 14

○ 12

○ 14

◉ 11

○ 13

Question 7
2 / 2 pts

What is the value of $2a - b$ if $M = \begin{pmatrix} a & 0.4 \\ 0.1 & b \end{pmatrix}$ represents a probabilistic operator?

○ 1.1

◉ 1.2

○ 0.3

○ 2.4

Incorrect

Question 8
0 / 2 pts

Question 8 — 0 / 2 pts

Which postulate of quantum mechanics tells us how quantum states evolve?

○ Postulate 4

○ Postulate 1

◉ Postulate 3

Question 9   2 / 2 pts

What are the possible values of x and y if the vector

$$v = \begin{pmatrix} x \\ y \\ 0.2 \\ 0.3 \end{pmatrix}$$ represents a probabilistic state?

- ◉ $x = 0.21, y = 0.29$
- ○ $x = 0.2, y = 0.4$
- ○ $x = 0.15, y = 0.15$
- ○ $x = 0.1, y = 0.35$

Question 10   2 / 2 pts

We have two biased coins C_1 and C_2. The probability of getting Tail after tossing C_1 is 0.7 and probability of getting Head after tossing C_2 is 0.6. What is the probability of getting both Tails after tossing C_1 and C_2?