Unit 9 - Week 7 - Approaches other than Linear approaches to " QIQC "

Assignment - 7

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-09-18, 23:59 IST.

1) Qubits are the quantum counterpart of bits used in traditional computing. While traditional bits represent data as 0s or 1s, qubits are distinguished by superposition, or by their ability to be both 0 and 1 at once. Qudits are quantum objects for which the number of possible states (say 'd') is greater than two. Which of the following is correct? *1 point*

- A 2-qudit system would result in an identical 2^d-number of qubits
- A qubit is a 2^1-dimensional system; likewise, a qudit is a d-dimensional system
- It is easier to control 2-qudits than a system of 2d-number of qubits
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
A qubit is a 2^1-dimensional system; likewise, a qudit is a d-dimensional system

2) A quantum system is said to be coherent as long as there exists a definite phase relation between different states in the quantum world. This fundamental property of 'coherence' in quantum mechanics is necessary for the functioning of quantum computers. Based on this, which of the following is incorrect? *1 point*

- Decoherence occurs when a quantum system is perfectly isolated
- Decoherence is the loss of coherence
- Decoherence comes about when a quantum state transitions to a classical state
- Decoherence can be viewed as loss of information from a system into environment

No, the answer is incorrect.
Score: 0
Accepted Answers:
Decoherence occurs when a quantum system is perfectly isolated

3) Even if an optical implementation approach of quantum information processing can utilize the phase information embedded in the data register, it may end up showing different levels of enhancement in computation as compared to its classical analog. This is because: *1 point*

- Quantum phenomena is both wave and particle like and exhibits entanglement
- Quantum phenomena is often negligible in the Macroscopic world
- Quantum phenomena is particle like and delivers energy in packets
- Quantum phenomena is wave like and is solely based on wave superposition

No, the answer is incorrect.
Score: 0
Accepted Answers:
Quantum phenomena is both wave and particle like and exhibits entanglement

4) Demonstration of all Optical Grover Search by utilizing pulse shaping alone by Walmsley in comparison to the use of pulse shaping with Cs atom data register of Bucksbaum proves: *1 point*

- Effective search algorithm cannot be implemented by classical wave interference
- Grover's search algorithm is incorrect if attempted quantum mechanically
- Classical wave interference cannot mimic a quantum system with no entanglement
- Classical wave interference can mimic a single quantum system possessing no entanglement and can implement effective search algorithm

No, the answer is incorrect.
Score: 0
Accepted Answers:
Classical wave interference can mimic a single quantum system possessing no entanglement and can implement effective search algorithm

5) Ever since the early days of quantum mechanics, there has been an implicit dream of controlling atomic and molecular dynamics. It was pursued with even greater vigor with the discovery of the first laser. However, such quantum mechanical "control" has remained an elusive issue. The main culprit for this failure is: *1 point*

- typically, strong coupling amongst the molecular degrees of freedom
- only energy randomization though still in coherence
- intermolecular vibrational relaxation
- all of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
typically, strong coupling amongst the molecular degrees of freedom

6) Besides the linear optical approaches that rely on the Bosonic nature of photons, which of the following approaches circumvents the "lack of interactions in photons" property to make multiple qubit operation possible? *1 point*

- Use a tight focus lens on a high photon flux laser output to force photons' proximity
- Use photon as an ideal spin carrier by tailoring the photon spin via light–matter interaction in liquid-crystal-based twisting structures
- both a) and b) are false
- both a) and b) above are correct

No, the answer is incorrect.
Score: 0
Accepted Answers:
Use photon as an ideal spin carrier by tailoring the photon spin via light–matter interaction in liquid-crystal-based twisting structures

7) In contrast to a single state vector that describes a quantum system in a pure state, a statistical ensemble of several quantum states corresponding to the density matrix or its linear operator called the density operator. Just as the Schrödinger equation describes how pure states evolve in time, an equivalent equation that describes how a density operator evolves in time is: *1 point*

- the Liouville Equation: $-i\hbar\frac{\partial\rho}{\partial t} = [\mathcal{H}, \rho]$, where $\rho = \sum_j p_j^* p_j |\psi\rangle\langle\psi|$
- the Liouville Equation: $i\hbar\frac{\partial\rho}{\partial t} = [\mathcal{H}, \rho]$, where $\rho = \sum_j p_j |\psi\rangle\langle\psi|$
- the Liouville Equation: $i\hbar\frac{\partial\rho}{\partial t} = [\mathcal{H}, \rho]$, where $\rho = \sum_j p_j^2 |\psi\rangle\langle\psi|$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
the Liouville Equation: $i\hbar\frac{\partial\rho}{\partial t} = [\mathcal{H}, \rho]$, where $\rho = \sum_j p_j |\psi\rangle\langle\psi|$

8) If a laser pulse is shaped such that its instantaneous frequency within the pulse changes smoothly from 'far above resonance' to 'far below resonance' through resonance for a simple two-level quantum system, then the quantum system would *1 point*

- result in two quantum states that are in coherence as long as the pulse is at resonance
- undergo Adiabatic rapid passage and the quantum system undergoes complete population inversion with all the population in the excited state immediately at the end of this pulse
- result in equal population between the two quantum states
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
undergo Adiabatic rapid passage and the quantum system undergoes complete population inversion with all the population in the excited state immediately at the end of this pulse

9) If a laser pulse can be shaped such that its instantaneous frequency within the pulse changes smoothly from 'far below resonance' to resonance and back down to 'far below resonance' for a simple two-level quantum system, then the quantum system would *1 point*

- ensure that the two quantum states are always in coherence
- always result in equal population between the two quantum states
- undergo Adiabatic rapid half passage and the two quantum states are in coherence as long as the pulse is at resonance
- always involves a total of half-integral photon number in the excited state

No, the answer is incorrect.
Score: 0
Accepted Answers:
undergo Adiabatic rapid half passage and the two quantum states are in coherence as long as the pulse is at resonance

10) The phenomenon of oscillatory behavior in the wave-packet revivals of experiments in Anthracene molecules' dynamics in its vibrational state populations may be modeled and controlled. The quantum interferences can be controlled through the control of *1 point*

- a superposition of all the vibrational states in the ground state of the molecule
- normal mode analysis of the Anthracene molecule
- intramolecular vibrational relaxation through ultrafast pulse shaping to result in Adiabatic Rapid Half Passage
- subjecting the Anthracene molecule to ionization conditions

No, the answer is incorrect.
Score: 0
Accepted Answers:
intramolecular vibrational relaxation through ultrafast pulse shaping to result in Adiabatic Rapid Half Passage