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Unit 7 - Week 6

Week 6 - Assignment 6

The due date for submitting this assignment has passed. **Due on 2017-09-06, 23:59 IST.**
As per our records you have not submitted this assignment.

In the following questions, ONLY ONE answer is correct. Choose the most appropriate one. (1X16=16 Marks)

1) In a classical communication, the sender transmits one of the following four codes : C:= {(000000), (101100), (010111), (111011)}. The probability of a single bit flip is p=0.15. If the receiver received (111111), what is most likely to have been the code sent? ***1 point***

- (000000)
- (101100)
- (010111)
- (111011)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(111011)

2) Given two vectors u and v representing two code words the Hamming distance between them is defined as the number of positions in which the two vectors differ. The minimum distance between the code words in the code C: = {(00000), (01110)(10011), (11111)} is ***1 point***

- 1
- 2
- 3
- 5

No, the answer is incorrect.
Score: 0

Accepted Answers:
2

3) Assuming that the probability of bit flip is uniform across all bits, the maximum number of bit flips that the code C in the previous question can detect is ***1 point***

- 1
- 2
- 3
- 4

No, the answer is incorrect.
Score: 0

Accepted Answers:
1

4) Assuming that the probability of bit flip is uniform across all bits, the number of bit flips that the code C in question 2 can correct is ***1 point***

- 0
- 1

- 2
- 3

No, the answer is incorrect.
Score: 0

Accepted Answers:
0

5) Suppose in a classical error code, five bits are employed to encode a single bit. What is the success probability when the bit is sent through a noisy channel one by one with a probability that a bit is flipped with a probability p=0.1, assuming a majority vote principle is used? ***1 point***

- 0.95
- 0.97
- 0.98
- 0.99

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.99

6) In a quantum error correcting code, a qubit $\frac{1}{\sqrt{2}}(|0\rangle + |1\rangle)$ is encoded as ***1 point***

- $\frac{1}{\sqrt{8}}(|0\rangle + |1\rangle)^{\otimes 3}$
- $\frac{1}{\sqrt{2}}(|000\rangle + |111\rangle)$
- $\frac{1}{\sqrt{8}}(|000\rangle + |111\rangle)^{\otimes 3}$
- None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{\sqrt{2}}(|000\rangle + |111\rangle)$

7) If p is the probability of a bit flip in a classical 3 bit repetition code, under what circumstances, the code is less reliable than transmission in an uncoded manner? ***1 point***

- p>0.01
- p>0.125
- p>0.25
- p>0.5

No, the answer is incorrect.
Score: 0

Accepted Answers:
p>0.5

8) In an error correcting model, an n-qubit code word is used for transmission. Assuming that only single bit flips are to be taken into account, what is the minimum word length n for which detection and recovery is possible? ***1 point***

- 2
- 3
- 5
- 9

No, the answer is incorrect.
Score: 0

Accepted Answers:

3

9) An arbitrary quantum state a|0⟩+b|1⟩ becomes, due to an error during transmission, the state a|1⟩-b|0⟩. The switch can be modeled by application of the following operator on the original state **1 point**

- σ_x
- $i\sigma_y$
- σ_z
- $i\sigma_x\sigma_y$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$i\sigma_y$

10) Suppose a σ_x error affects the first qubit of an entangled state $\frac{1}{\sqrt{2}}(|00\rangle + |11\rangle)$. The error can be detecting by measurement of the following operator **1 point**

- $\sigma_x \otimes \sigma_x$
- $\sigma_x \otimes \sigma_z$
- $\sigma_z \otimes \sigma_z$
- $\sigma_z \otimes \sigma_x$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\sigma_z \otimes \sigma_z$

11) Suppose a σ_z error affects the first qubit of an entangled state $\frac{1}{\sqrt{2}}(|00\rangle + |11\rangle)$ The error can be detecting by measurement of the following operator **1 point**

- $\sigma_x \otimes \sigma_x$
- $\sigma_x \otimes \sigma_z$
- $\sigma_z \otimes \sigma_z$
- $\sigma_z \otimes \sigma_x$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\sigma_x \otimes \sigma_x$

12) In a 3 qubit error code, the ancilla are measured to be in state |10⟩, consequent to which σ_x is applied to the second qubit. In addition to recovering the original state |ψ⟩=a|000⟩+b|111⟩, which of the following outcomes is also possible? **1 point**

- a|001⟩+b|110⟩
- a|100⟩+b|011⟩
- a|100⟩+b|111⟩
- a|101⟩+b|010⟩

No, the answer is incorrect.
Score: 0

Accepted Answers:

a|101⟩+b|010⟩

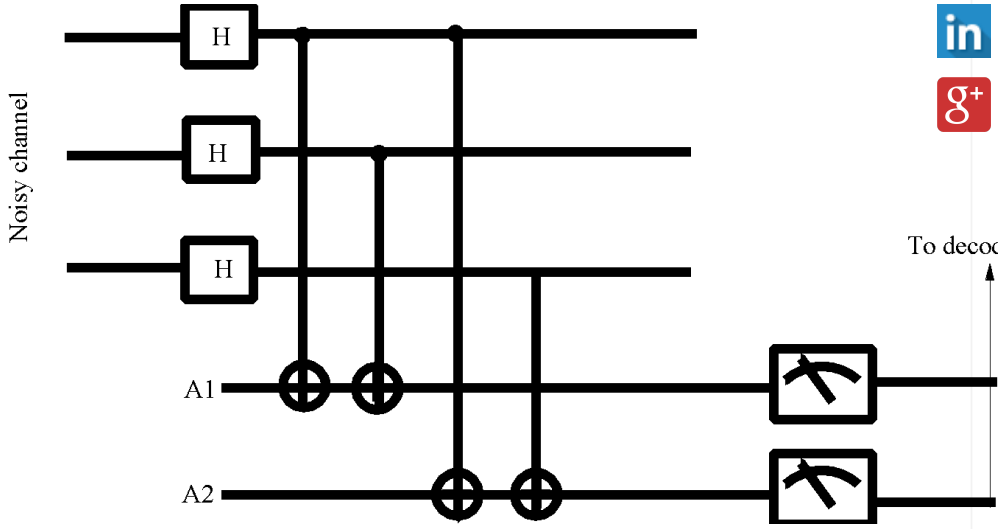
13) In 3 qubit error code, if the ancilla states are measured to be |11⟩, one can conclude that **1 point**

- A bit flip error has occurred in the first qubit
- A bit flip error either in the third qubit or in both second and third qubits
- A bit flip error either in the third qubit or in both first and second and qubits
- A bit flip error has occurred in the third qubit only

No, the answer is incorrect.
Score: 0

Accepted Answers:
A bit flip error has occurred in the first qubit

14) In the 3 qubit code, |0⟩ was encoded as |+++⟩ and |1⟩ was coded as |---⟩. Consider the following modification to the error detection circuit. **1 po**



The ancilla are measured in computational basis. If the result of measurement is |01⟩, it is indicative of a

- phase flip in qubit 1
- bit flip in qubit 3
- phase flip in qubit 3
- bit flip in qubit 1

No, the answer is incorrect.
Score: 0

Accepted Answers:
phase flip in qubit 3

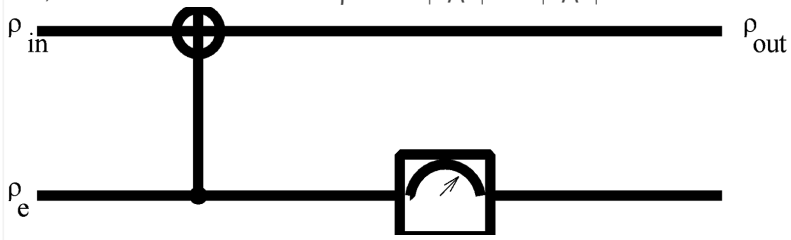
15) In 3 qubit code the state $|+\rangle$ is encoded as $|\tilde{+}\rangle = \frac{1}{\sqrt{2}}(|000\rangle + |111\rangle)$. If an error E=Z⊗I⊗I occurs, then the syndrome extraction using ancilla states results in detection of **1 point**

- A phase error in qubit 1
- A phase error in qubit 2 and 3
- A bit flip error in qubit 1
- No error is detected

No, the answer is incorrect.
Score: 0

Accepted Answers:
No error is detected

16) In the circuit shown below ρe=0.25|0⟩⟨0|-0.75|1⟩⟨1| **1 point**



The process depicted is

- A bit flip and a phase flip with probability 0.25
- A bit flip and a phase flip with probability 0.75
- A phase flip with probability 0.75
- A phase flip with probability 0.25

No, the answer is incorrect.
Score: 0

Accepted Answers:
A bit flip and a phase flip with probability 0.75

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