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Unit 8 - Week 7

Week 7 - Assignment 7

The due date for submitting this assignment has passed. Due on 2017-09-13, 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. (1X8=8 Marks)

1) X is an unknown 8 bit binary number. You are given another 8 bit number Y and old that the number X differs from Y in exactly one position. How many bits of information you have been given about X? ***1 point***

- 1
- $log_2 7$
- 3
- 5

No, the answer is incorrect.
Score: 0

Accepted Answers:
5

2) In a population sample males and females are equally distributed. The literacy rate among males is 80% while that among females is 60%. How many bits of information do you get on learning that a female is also literate? ***1 point***

- 0.51
- 0.61
- 1.22
- 1.74

No, the answer is incorrect.
Score: 0

Accepted Answers:
1.22

3) A source emits 3 symbols A, B, and C in a statistically independent sequence with probability 0.5, 0.25 and 0.25 respectively. The entropy of the process is (in bits per symbol) ***1 point***

- 1.5
- 1
- 0.33
- 0.67

No, the answer is incorrect.
Score: 0

Accepted Answers:
1.5

4) A message is formed from 4 letters A, B, C and D with their respective probabilities being 0.5, 0.25, 0.125 and 0.125. The shortest possible length to which a message of 100 letters may be encoded is **1 point**

- 213
- 175
- 50
- 25

No, the answer is incorrect.
Score: 0

Accepted Answers:
50

5) A card deck contains 52 playing cards. One of these is drawn at random. Given that the drawn card is a heart, the amount of uncertainty that the card drawn is a king of hearts is (in bits) **1 po**

- 5.7
- 3.7
- 3
- 2

No, the answer is incorrect.
Score: 0

Accepted Answers:
3.7

6) The von Neumann entropy (in bits) for the state described by the density matrix **1 point**

$$\begin{bmatrix} \frac{1}{3} & 0 & 0 & \frac{1}{6} \\ 0 & \frac{1}{6} & 0 & 0 \\ 0 & 0 & \frac{1}{6} & 0 \\ \frac{1}{6} & 0 & 0 & \frac{1}{3} \end{bmatrix}$$ is given by:

- $S = log_2 2 + \frac{1}{2} log_2 3$
- $S = log_2 2 - \frac{1}{2} log_2 3$
- $S = log_2 3 + \frac{1}{2} log_2 2$
- $S = log_2 3 - \frac{1}{2} log_2 2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$S = log_2 2 + \frac{1}{2} log_2 3$

7) Entropy of the reduced density matrix provides a measure of entanglement of a state, more the entropy, more is the entanglement. Consider the following states: **1 point**

1. $|\psi 1\rangle = 0.8\,|00\rangle + 0.6\,|11\rangle$
2. $|\psi 2\rangle = 0.6\,|00\rangle + 0.8\,|11\rangle$
3. $|\psi 3\rangle = 12\,(|00\rangle + |11\rangle)$

Which of the following statements is correct?

- The state $|\psi 1\rangle$ is more entangled than $|\psi 2\rangle$
- The state $|\psi 2\rangle$ is more entangled than $|\psi 1\rangle$

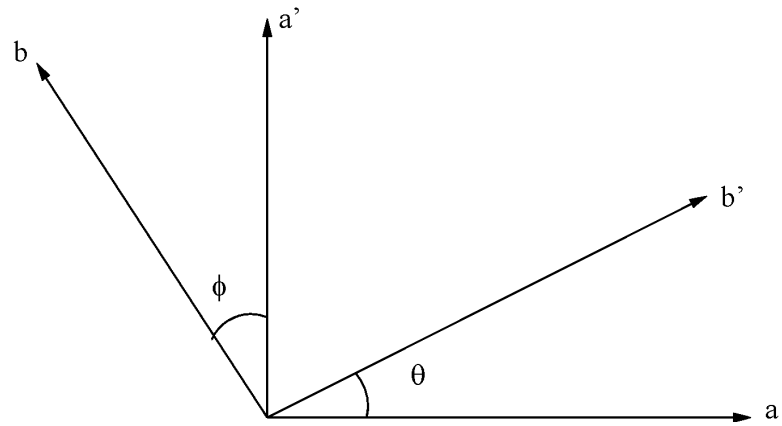
The entanglement measure of both |ψ1⟩ and |ψ2⟩ are the same and each of the states is more entangled than |ψ3⟩

The entanglement measure of both |ψ1⟩ and |ψ2⟩ are the same and each of the states is less entangled than |ψ3⟩

No, the answer is incorrect.
Score: 0

Accepted Answers:
The entanglement measure of both |ψ1⟩ and |ψ2⟩ are the same and each of the states is less entangled than |ψ3⟩

8) In an experiment to verify Bell's inequality, Alice and Bob share a Bell state $|01\rangle+|10\rangle/\sqrt{2}$ with Alice having the first particle. Alice chooses two directions shown as a and a' in the figure while Bob chooses his directions to be b and b'. They measure their spins in these directions getting ±1. ***1 po***



If cos ϕ=3/5 and cos θ =4/5, then the expectation value -E(a,b)+E(a,b')+E(a',b)+E(a',b') is

-2.8

2.8

$-2\sqrt{2}$

$2\sqrt{2}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
2.8

In the following questions, ONE or MORE answer(s) is(are correct). Choose all the appropriate ones. (2X4=8 Marks)

9) A discrete random variable X takes values {0,1} with probability of X=1 being p and that of X=0 being 1-p. The Shannon entropy function has the following properties as a function of p ***2 points***

H(p)=0 when p=0 or p=1

H(p)=H(1-p) for every p∈{0,1}

It is a convex function of p

H(p)>0 for all p

No, the answer is incorrect.
Score: 0

Accepted Answers:
H(p)=0 when p=0 or p=1
H(p)=H(1-p) for every p∈{0,1}

10) Which of the following statements is (are) true for von Neumann entropy S(ρ) where ρ is the density matrix **2 points**

- [ ] If S(A)=S(B) for two states A and B, the two states are identical
- [ ] Tr(ρ)=1 implies S(ρ)=0
- [ ] S(ρ)=0 implies Tr(ρ*ρ)=1
- [ ] Tr(ρ*ρ)=1 implies S(ρ)=0

No, the answer is incorrect.
Score: 0

Accepted Answers:
*S(ρ)=0 implies Tr(ρ*ρ)=1*
*Tr(ρ*ρ)=1 implies S(ρ)=0*

11) Consider a state in $H_A \times H_B$ where $H_A = H_B = C^2$. For a state given by $\frac{1}{2}\begin{bmatrix} 1 & -1 \\ 1 & -1 \end{bmatrix}$, the von Neumann entropy satisfies the following. **2 poi**

- [ ] $S \neq 0$
- [ ] $S_A = 0$
- [ ] $S_B = 0$
- [ ] $S = 0,\ but\ S_A \neq 0,\ S_B \neq 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$S_A = 0$
$S_B = 0$

12) According to Einstein, Podolsky and Rosen (EPR), quantum mechanics is an incomplete theory because **2 points**

- [ ] it does not take account of reality.
- [ ] the theory can result in information transfer at a rate which violates special theory of relativity
- [ ] there are hidden variables in the theory
- [ ] result of the theory is not deterministic before a measurement is made

No, the answer is incorrect.
Score: 0

Accepted Answers:
it does not take account of reality.
the theory can result in information transfer at a rate which violates special theory of relativity
result of the theory is not deterministic before a measurement is made

Previous Page End