AI ALIGNMENT COHORT - Session 1 Assignment

Hi everyone, here are some questions to brush up your concepts of Linear Algebra and Information Theory!
These assignments will not be graded and you are open to use resources to understand the questions and also feel free to check answers if you find it hard to understand. But make it a point to grasp it at the end of the day!

* Indicates required question

1. Name *

2. Email *

3. Discord ID *

4. Which of the following statements is true about linear transformations?

Mark only one oval.

- A linear transformation always changes the dimensions of the vector space.
- A linear transformation can be represented by a matrix multiplication.
- A linear transformation can only scale vectors, not rotate them.
- A linear transformation is a type of transformation that preserves angles but not distances.

5. Which of the following statements is true about the rank of a matrix?

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- ◯ The rank of a matrix is the number of columns in the matrix.
- ◯ The rank of a matrix is the number of rows in the matrix.
- ◯ The rank of a matrix is the number of non-zero rows in its row echelon form.
- ◯ The rank of a matrix is always equal to the smaller of the number of rows or columns.

6. Which of the following best describes the significance of a zero determinant for a square matrix A?

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- ◯ A is a diagonal matrix.
- ◯ A has no real eigenvalues.
- ◯ A does not change the area or volume of the transformed space.
- ◯ A maps some non-zero vector to the zero vector.

7. Which of the following statements is NOT true about eigenvectors and eigenvalues?

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- ◯ The eigenvalues of a matrix A are the roots of its characteristic polynomial.
- ◯ A matrix always has the same number of eigenvectors as its size (i.e., an n x n matrix has n eigenvectors)
- ◯ Eigenvectors corresponding to distinct eigenvalues of a symmetric matrix are orthogonal.
- ◯ If v is an eigenvector of a matrix A with eigenvalue λ, then any scalar multiple of v is also an eigenvector of A with eigenvalue λ.

8. What is entropy in the context of information theory?

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- The measure of predictability of a random variable.
- The amount of information needed to describe the state of a system
- The difference between expected and observed outcomes.
- The similarity between two probability distributions.

9. If a random variable X can take on 4 equally likely outcomes, what is the entropy H(X)?

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- 1 bit
- 2 bit
- 3 bit
- 4 bit

10. What does KL Divergence measure?

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- The similarity between two probability distributions.
- The difference between two probability distributions.
- The sum of two probability distributions.
- The product of two probability distributions.

11. When minimizing the Cross-Entropy Loss, what is implicitly minimized?

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- The entropy of the predictions.
- The KL Divergence between the predicted and true distributions.
- The mutual information between input and output.
- The variance of the predictions.