

CS-150: Pre-assessment Survey

Saeed Mehraban

Spring, 2024

Guidelines: From the moment you read the first problem you have 15 minutes to complete this survey; please don't use more time. The goal of this pre-assessment survey is for us to get a sense of your background in linear algebra and probability. This will help us organize the lectures, and **your score will not impact your grade**. Please do not collaborate with each other and do respond independently to this survey and submit your responses to Gradescope by the beginning of Monday's class. Best wishes!

Problem 1 True or false? The matrix $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ has only real eigenvalues.

- True
- False
- Not sure

Problem 2 True or false? The matrix $A = \begin{pmatrix} 1 & 20 \\ 20 & 4 \end{pmatrix}$ is positive semi-definite, i.e. it satisfies $x^* A x \geq 0$ for all $x \in \mathbb{C}^2$ (x^* is the row-vector produced by transposing x and taking the entry-wise complex conjugate).

- True
- False
- Not sure

Problem 3 If we rotate the vector $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$ 30 degrees clockwise what is the resulting vector?

- $\begin{pmatrix} \sqrt{3}/2 \\ 1/2 \end{pmatrix}$
- $\begin{pmatrix} \sqrt{3}/2 \\ -1/2 \end{pmatrix}$
- $\begin{pmatrix} 1/2 \\ 1/2 \end{pmatrix}$
- Not sure

Problem 4 True or false? $i = \sqrt{-1}$ is an eigenvalue of $\begin{pmatrix} 1 & 2 & 3 \\ 2 & 5 & 0 \\ 3 & 0 & 7 \end{pmatrix}$.

- True

False

Not sure

Problem 5 True or false? If O is an orthogonal matrix, i.e., it satisfies $O^T = O^{-1}$, it can have an eigenvalue of 2. (O^T is the matrix produced by transposing O).

True

False

Not sure

Problem 6 True or false? $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ is an eigenvector of $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$.

True, it has an eigenvalue of +1

True, it has an eigenvalue of -1

False

Not sure

Problem 7 Consider the probability distribution over two bits x_1, x_2 such that $\Pr(x_1 = 0, x_2 = 0) = 1/4, \Pr(x_1 = 0, x_2 = 1) = 1/8, \Pr(x_1 = 1, x_2 = 0) = 1/8$. What is the probability $\Pr(x_2 = 1 | x_1 = 1)$?

1/2

1/4

4/5

Not sure

Problem 8 In a 52-card deck, there are 4 suits of 13 cards each. Conditioned on the event of first drawing the Ace of Spades, what is the probability that the second card drawn is a face-card (Jack, Queen or King) from Spades?

12/52

3/52

3/51

Not sure