

Name: _____

PID: _____

This is the 8th quiz of CSE255/DSE230

On your desk you should have only the exam paper and writing tools.

No hats or hoods allowed (unless religious items).

There are 5 questions in this quiz, each worth 20 points.

You have 20 minutes to complete the exam.

Start by writing your name and PID on this page.

Good Luck!

Define an ϵ -cover of a set S to be a set balls of radius ϵ that cover the set (i.e. S is a subset of the union of the balls). Let $N(\epsilon)$ be the *minimal* number of balls of radius ϵ needed to cover S .

Define the **intrinsic dimension** of S to be the minimal value of d such that there exists a positive, finite, real number C such that:

$$\forall \epsilon > 0, \quad N(\epsilon) < \frac{C}{\epsilon^d}$$

Let \vec{a}, \vec{b} be independent vectors in R^D . In all of the questions below, assume $\|\vec{x}\|_2 \leq 100$.

What is the intrinsic dimension of the following sets?

1. $\{\alpha \vec{a} \text{ such that } \alpha \in R\}$ _____
2. $\{\vec{x} \text{ such that } \vec{x} \cdot \vec{a} = 5\}$ _____
3. $\{\alpha \vec{a} + \beta \vec{b} \text{ such that } |\alpha| + |\beta| = 1\}$ _____
4. $\{\vec{x} \text{ such that } \vec{x} \cdot \vec{a} < 5 \text{ and } \vec{x} \cdot \vec{b} = 0\}$ _____
5. $\{\alpha \vec{a} \text{ such that } \alpha \in \{-1, 0, +1\}\}$ _____