

- (1) This is an open book, open notes exam. You are free to consult any text book or notes. **You are not allowed to consult with any other person.**
- (2) If you need any clarification, please post a private message to the instructors on Piazza.
- (3) Remember that your work is graded on the *clarity* of your writing and explanation as well as the validity of what you write.
- (4) This is a one-hour exam.

- (1) State whether the following statements are true or false. Justify your answer.
 - (a) (5 points) Any diagonal matrix is a valid kernel matrix. (Recall that a matrix A is called diagonal if for all $i \neq j$, $A_{ij} = 0$.)

(b) (5 points) If $K(x, z)$ is a kernel function, then for all x and z , $K(x, x) + K(z, z) - 2K(x, z) \geq 0$.

(2) For each of the following functions, state if they are a kernel function. If yes, provide the corresponding feature map; if no, provide a short proof.

(a) (5 points) S and T are subsets of $\{1, 2, \dots, 100\}$. $K(S, T) = |S \cup T|$.

(b) (5 points) S and T are subsets of $\{1, 2, \dots, 100\}$. $K(S, T) = |S \cap T|$.