(1) This is a closed book, closed notes exam. Switch off your cell phone and do not communicate with anyone other than an exam proctor.

(2) Start writing when instructed. Stop writing when your time is up.

(3) When you are ready to submit, stay in your seat and raise your hand.

(1) (5 Points) Suppose there is a single feature, denoted by $X$ which takes values in the set $\{1, 2, 3\}$ and a binary label $Y \in \{0, 1\}$. The distribution $D$ is described as follows:

$$\Pr(X = i) = \frac{1}{3}, \ i \in \{1, 2, 3\}$$

$$\Pr(Y = 1|X = i) = 1, \ i \in \{1, 3\}$$

$$\Pr(Y = 0|X = i) = 1, \ i \in \{2\}$$

Let $h$ be the classifier: $h(x) = 1$ if $x > 1.5$ and 0 otherwise. Calculate the error of $h$ with respect to $D$.

(2) (5 Points) Suppose you have a dataset of images of digits, and you use it to build a linear classifier for classifying the images into the corresponding digits. Which of the following actions may reduce the bias of your classifier? Justify your answer.

(a) Collect more training data.

(b) Switch to a kernel classifier with a quadratic kernel (that is, where $K(x, z) = \langle x, z \rangle^2$).