CSE 151A Winter 2021 - Take Home Exam 3

1 hour **Name:** **PID:**

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(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) Let X and Y be two random variables with the following joint distribution.

	$X=1$	$X=2$	$X=3$
$Y=0$	1/2	1/10	1/10
$Y=1$	1/10	1/5	0

(a) (2 points) Calculate the marginal distributions of X and Y.

(b) (4 points) Calculate the conditional distributions of $X|Y=0$ and $X|Y=1$.

(c) (4 points) Now calculate the conditional entropy $H(X|Y)$. (It is okay to leave the final expression in terms of various logarithms).

(2) State whether the following statements are true or false. Justify your answer.

(a) Suppose S is a training dataset where each feature vector x_i is unique. Then the ID3 Decision tree constructed on S (without pruning) has zero training error.

(b) Pruning an ID3 Decision Tree will never increase its validation error.