1. You are working on a spam classification system using regularized logistic regression. "Spam" is a positive class (y = 1) and "not spam" is the negative class (y = 0). You have trained your classifier and there are m = 1000 examples in the cross-validation set. The chart of predicted class vs. actual class is:

	Actual Class: 1	Actual Class: 0
Predicted Class: 1	85	890
Predicted Class: 0	15	10

For reference:

- Accuracy = (true positives + true negatives) / (total examples)
- Precision = (true positives) / (true positives + false positives)
- Recall = (true positives) / (true positives + false negatives)
- F_1 score = (2 * precision * recall) / (precision + recall)

What is the classifier's F_1 score (as a value from 0 to 1)?

Enter your answer in the box below. If necessary, provide at least two values after the decimal point.

0.15813953486

2. Suppose a massive dataset is available for training a learning algorithm. Training on a lot of data is likely to give good performance when two of the following conditions hold true.

Which are the two?

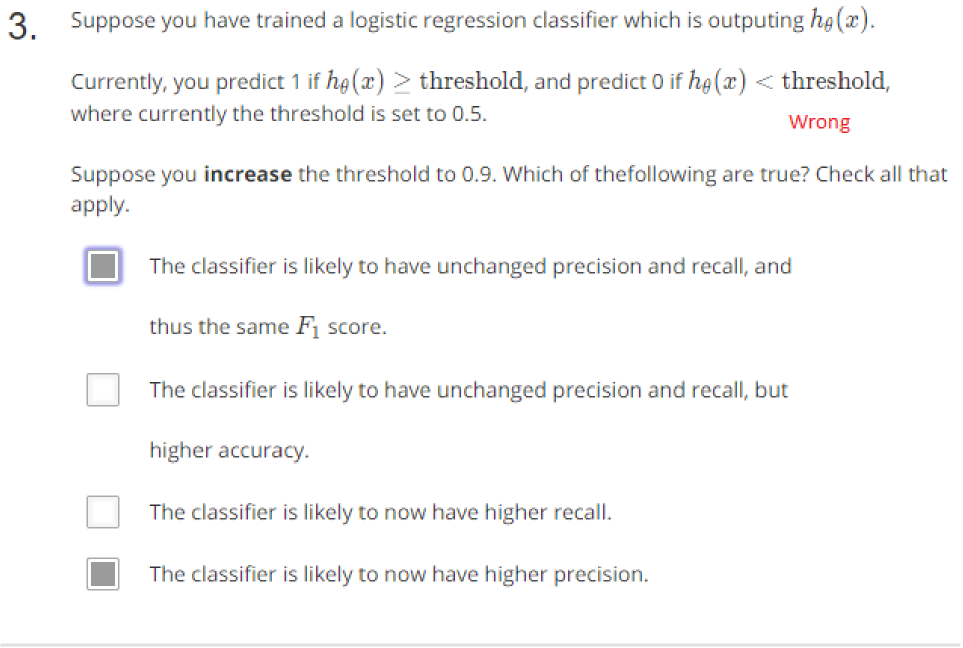
Wrong

□ We train a learning algorithm with a large number of parameters (that is able to learn/represent fairly complex functions).

☑ We train a model that does not use regularization.

☑ The features x contain sufficient information to predict y accurately. (For example, one way to verify this is if a human expert on the domain can confidently predict y when given only x).

□ We train a learning algorithm with a small number of parameters (that is thus unlikely to overfit).



3. Suppose you have trained a logistic regression classifier which is outputing $h_\theta(x)$.

Currently, you predict 1 if $h_\theta(x) \geq \text{threshold}$, and predict 0 if $h_\theta(x) < \text{threshold}$, where currently the threshold is set to 0.5.

Wrong

Suppose you **increase** the threshold to 0.9. Which of thefollowing are true? Check all that apply.

☒ The classifier is likely to have unchanged precision and recall, and

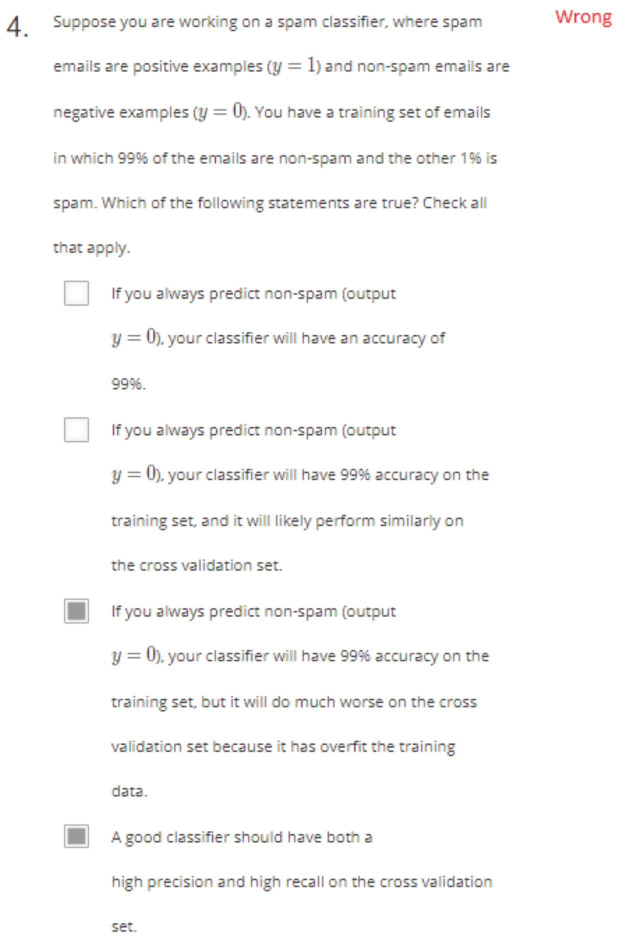
thus the same F_1 score.

□ The classifier is likely to have unchanged precision and recall, but

higher accuracy.

□ The classifier is likely to now have higher recall.

☒ The classifier is likely to now have higher precision.



4. Suppose you are working on a spam classifier, where spam emails are positive examples ($y = 1$) and non-spam emails are negative examples ($y = 0$). You have a training set of emails in which 99% of the emails are non-spam and the other 1% is spam. Which of the following statements are true? Check all that apply.

Wrong

□ If you always predict non-spam (output $y = 0$), your classifier will have an accuracy of 99%.

□ If you always predict non-spam (output $y = 0$), your classifier will have 99% accuracy on the training set, and it will likely perform similarly on the cross validation set.

☒ If you always predict non-spam (output $y = 0$), your classifier will have 99% accuracy on the training set, but it will do much worse on the cross validation set because it has overfit the training data.

☒ A good classifier should have both a high precision and high recall on the cross validation set.

5. Which of the following statements are true? Check all that apply.

- ☑ Using a **very large** training set makes it unlikely for model to overfit the training data.
- ☑ On skewed datasets (e.g., when there are more positive examples than negative examples), accuracy is not a good measure of performance and you should instead use F_1 score based on the precision and recall.
- □ After training a logistic regression classifier, you **must** use 0.5 as your threshold for predicting whether an example is positive or negative.
- □ It is a good idea to spend a lot of time collecting a **large** amount of data before building your first version of a learning algorithm.
- □ If your model is underfitting the training set, then obtaining more data is likely to help.

2. Suppose a massive dataset is available for training a learning algorithm. Training on a lot of data is likely to give good performance when two of the following conditions hold true.

Which are the two?

□ We train a learning algorithm with a small number of parameters (that is thus unlikely to overfit).

☑ The features x contain sufficient information to predict y accurately. (For example, one way to verify this is if a human expert on the domain can confidently predict y when given only x).

□ We train a model that does not use regularization.

☑ We train a learning algorithm with a large number of parameters (that is able to learn/represent fairly complex functions).

3. Suppose you have trained a logistic regression classifier which is outputing $h_\theta(x)$.

Currently, you predict 1 if $h_\theta(x) \geq \text{threshold}$, and predict 0 if $h_\theta(x) < \text{threshold}$, where currently the threshold is set to 0.5.

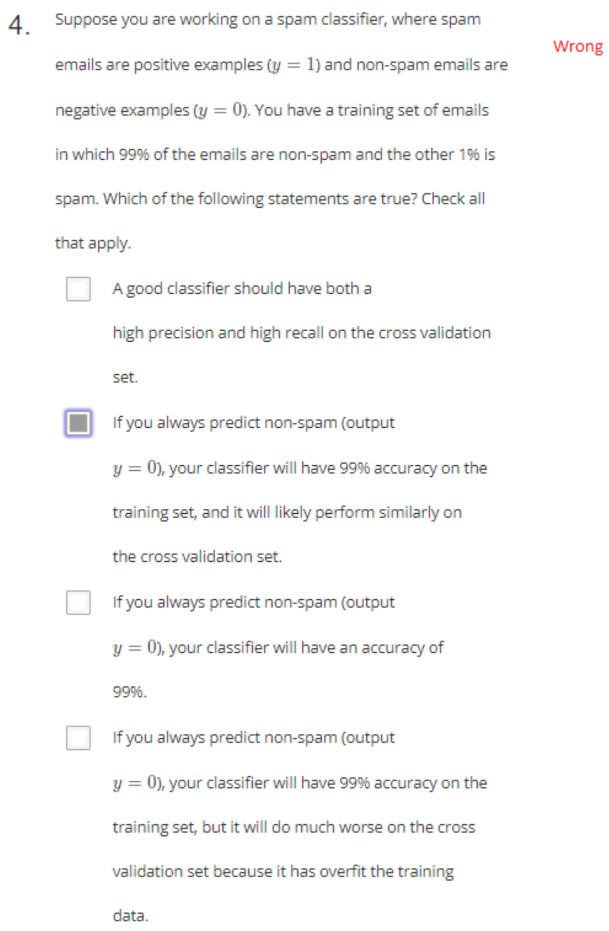
Suppose you **increase** the threshold to 0.7. Which of the following are true? Check all that apply.

☑ The classifier is likely to now have lower recall.

□ The classifier is likely to now have lower precision.

□ The classifier is likely to have unchanged precision and recall, but higher accuracy.

□ The classifier is likely to have unchanged precision and recall, but lower accuracy.



4. Suppose you are working on a spam classifier, where spam emails are positive examples ($y = 1$) and non-spam emails are negative examples ($y = 0$). You have a training set of emails in which 99% of the emails are non-spam and the other 1% is spam. Which of the following statements are true? Check all that apply.

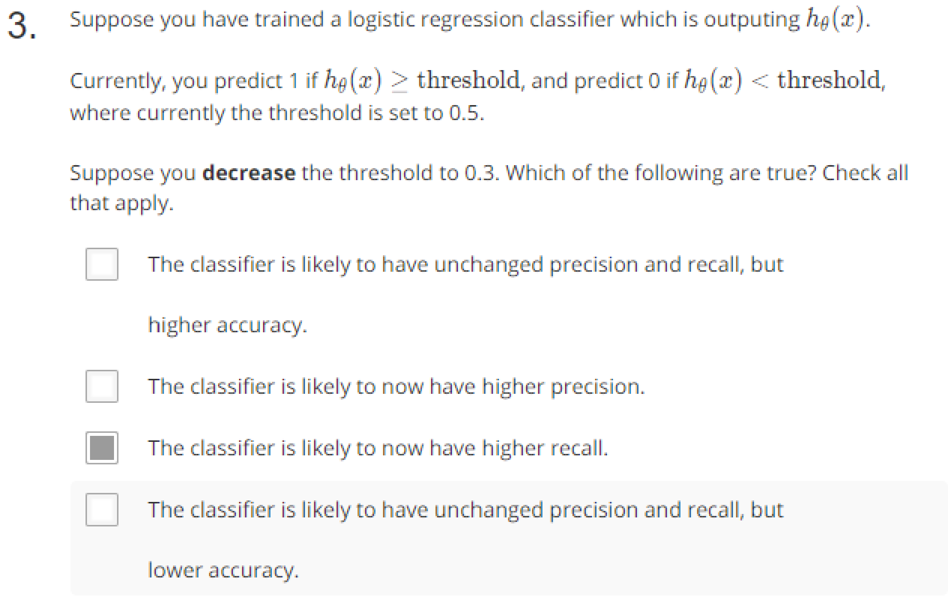
Wrong

□ A good classifier should have both a high precision and high recall on the cross validation set.

■ If you always predict non-spam (output $y = 0$), your classifier will have 99% accuracy on the training set, and it will likely perform similarly on the cross validation set.

□ If you always predict non-spam (output $y = 0$), your classifier will have an accuracy of 99%.

□ If you always predict non-spam (output $y = 0$), your classifier will have 99% accuracy on the training set, but it will do much worse on the cross validation set because it has overfit the training data.



3. Suppose you have trained a logistic regression classifier which is outputing $h_\theta(x)$.

Currently, you predict 1 if $h_\theta(x) \geq \text{threshold}$, and predict 0 if $h_\theta(x) < \text{threshold}$, where currently the threshold is set to 0.5.

Suppose you **decrease** the threshold to 0.3. Which of the following are true? Check all that apply.

□ The classifier is likely to have unchanged precision and recall, but higher accuracy.

□ The classifier is likely to now have higher precision.

■ The classifier is likely to now have higher recall.

□ The classifier is likely to have unchanged precision and recall, but lower accuracy.

4. Suppose you are working on a spam classifier, where spam emails are positive examples ($y = 1$) and non-spam emails are negative examples ($y = 0$). You have a training set of emails in which 99% of the emails are non-spam and the other 1% is spam. Which of the following statements are true? Check all that apply.

□ If you always predict spam (output $y = 1$), your classifier will have a recall of 0% and precision of 99%.

☑ If you always predict spam (output $y = 1$), your classifier will have a recall of 100% and precision of 1%.

☑ If you always predict non-spam (output $y = 0$), your classifier will have an accuracy of 99%.

☑ If you always predict non-spam (output $y = 0$), your classifier will have a recall of 0%.