4. What is the sensitivity and specificity of a model which randomly assigns a score between 0 and 1 to each example (with equal probability) if we use a threshold of 0.7? **1 / 1 point**

- ○ Sensitivity = 0.5, Specificity = 0.5
- ○ Sensitivity = 0.7, Specificity = 0.3
- ◉ Sensitivity = 0.3, Specificity = 0.7
- ○ Not enough information to answer the question.

Correct

$$Sensitivity = \frac{TP}{TP + FN}$$

$$Specificity = \frac{TN}{TN + FP}$$

$$Sensitivity = P(p\hat{o}s|pos) = P(score > 0.7|pos)$$

Our score is independent of the input data (it randomly assigns 0 or 1 predictions) so

$$P(score > 0.7|pos) = P(score > 0.7) = 0.3$$

Similarly,

$$specificity = P(n\hat{e}g|neg) = P(score < 0.7|neg) = P(score < 0.7) = 0.7$$

6. You have a model such that the lowest score for a positive example is higher than the maximum score for a negative example. What is its ROC AUC? **1 / 1 point**

HINT 1: watch the video "Varying the threshold".

HINT 2: draw a number line and choose values for the score that is the lowest prediction for any positive example, and choose another number that is the score for the highest prediction for any negative example. Draw a few circles for "positive" examples and a few "x" for the negative examples. What do you notice about the model's ability to identify positive and negative examples?

- ○ 0.82
- ○ Not enough information is given
- ○ 0.52
- ◉ 1.0

Correct

The model perfectly discriminates between positive and negative examples.

Pretend that the score predictions for all positive examples is 0.5 or higher, and the score predictions for all the negative examples are less than 0.5. Then all the positive examples have prediction scores of 0.5 or higher. All the negative examples have prediction scores less than 0.5. They are perfectly separated.

For any thresholds > 0.5, the specificity will be 1.0 (it correctly identifies all the negative examples), and the sensitivity will range from 0 to 1, so the points will run along the line y=1 (in the plot of the ROC curve, it will be the top horizontal edge of the chart.

At the threshold 0.5, the sensitivity (ability to correctly identify positive examples) will be 1.0 and the specificity will also be 1.0, so the point will be at the top right corner of the ROC curve.

At any threshold < 0.5, the sensitivity (ability to identify positive examples) will be 1.0 and the specificity will range from 1 to 0, so the point will be along the line x = 1 (the right side edge of the ROC Curve chart.

So the ROC curve is a box with width 1 and height 1, so the area under it is 1.0.