Name:

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| --- | --- | --- |
| Problem | Points | Score |
| 1(a) | 20 |  |
| 1(b) | 20 |  |
| 1(c) | 10 |  |
| 2(a) | 20 |  |
| 2(b) | 30 |  |
| Total | 100 |  |

Notes:

1. The exam is closed books and notes except for one double-sided sheet of notes.
2. Please indicate clearly your answer to the problem.
3. Note that ungrammatical sentences, incoherent statements, or general illegible scratches will get zero credit.
4. If I can’t read or follow your solution, it is wrong, and no partial credit will be awarded.

**Problem No. 1**: Consider two probability distributions representing a 2-class problem:

where and .

1. (20 pts) Sketch the probability of error as a function of α. Very carefully label your graph and be as precise as possible. Hint: sketch these distributions.
2. (20 pts) For what value of α is the probability of error a maximum? Draw a sketch of the corresponding distributions to justify your choice.
3. (10 pts) Suppose you weight your errors such that: and . How would your answers to (a) and (b) change? Be as precise as possible in your arguments.

**Problem No. 2**: Suppose we have a discrete random variable, X, that takes on one of two values, 0 or 1, with the following probabilities:

1. (20 pts) What is the mean of this distribution?
2. (30 pts) What is the maximum likelihood estimate of ? Justify your answer.