MIDTERM

Midterm!

- Hour long exam.

- 105 possible points
  - 5 bonus points

- ***Allowed***: Cheatsheet, calculator, pen

- ***Not Allowed***: anything else!

Midterm Question

- Short Question:
  - **True/False:** *"the decision boundary of perceptron and dual perceptron with RBF kernel are similar"*
  - **How would you../what would be the result of doing:**
    - *Reducing the size of a decision tree/changing learning rate.*

- *Short answers (1-2 sentences), consisting of answer (e.g., true/false) and a short explanation*
- **Avoid guessing**. *We really just care about the explanation*

Midterm Question

- Calculation Questions:
  - Simulate an algorithm run on some data (small set)
  - Understand the principle behind the algorithm's performance

- Bring a calculator, mostly so you don't waste time.

- If you did the HW you should be fine.

- Make sure answers to questions are consistent with the algorithm "run"

Midterm Questions

- Algorithmic Questions:
  - Adapt the algorithms we have seen to work better in a given setting (little data, high dimensional data, level of noise, etc.)
  - Adapt the algorithms we have seen to new scenarios (come up with new algorithms)
    - We have seen algorithms for learning monotone conjunctions, computing kernels etc. *How can these algorithms be changed?*
  - Analyze algorithms performance

Midterm Questions

- Theoretical Question:
    - Combinatorial questions (counting) and the connection to relevant to ML concepts
    - Show that an algorithm is a mistake bound algorithm
    - Understand the difference between hypothesis classes

- *Make sure to review the definitions and understand them!*

Midterm Topics

- KNN
- Decision Trees
- Learning Boolean Functions
- Winnow
- Perceptron
- Multi-class classification
- Gradient Descent (as far as we'll get today)
- Mistake Bounds analysis, Perceptron convergence
- Performance evaluation, cross-validations, overfitting and underfitting.
- Connections between concepts (how does DT control overfitting?)

- ***Explain***. What is one similarity and one difference between..
  - Winnow and Perceptron
- ***Pick an option and <u>explain</u>***.
  - Overfitting is more likely in Decision trees or Perceptron.
- ***True or False.*** A dual perceptron with a linear kernel has the same expressive power as a primal perceptron.
- ***True or False***: the size of the hypothesis space (e.g., 3^n for conjunctions, 2^{2^n} for Boolean Functions) is a good indicator for the expressiveness of the space
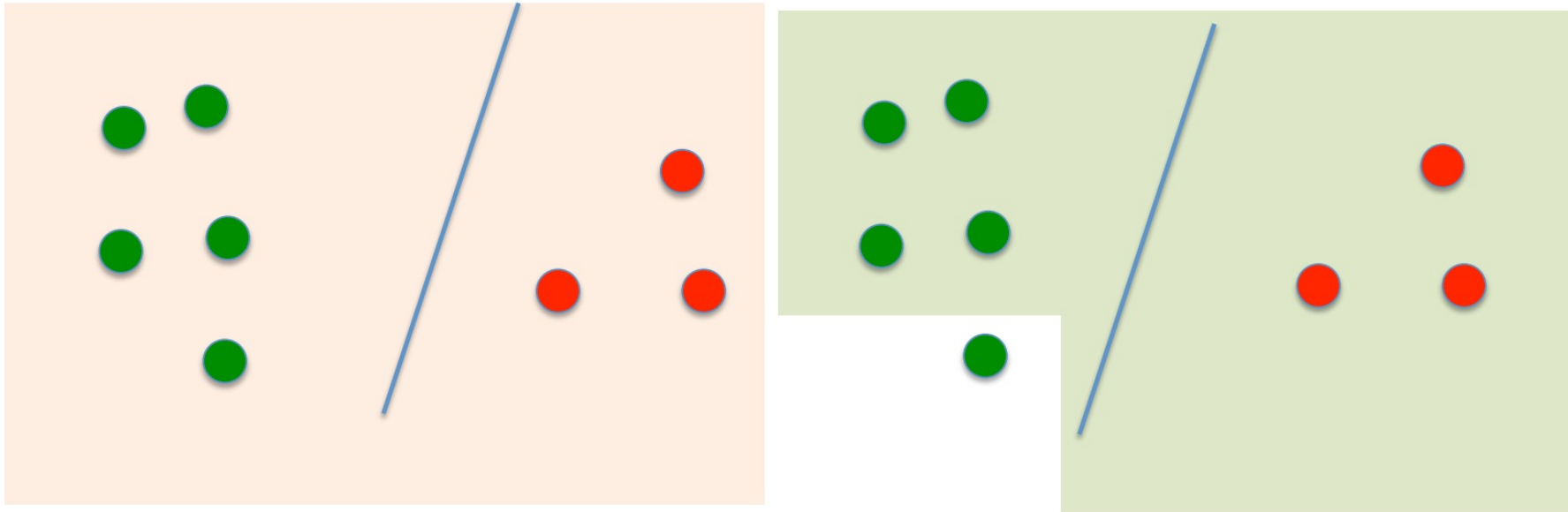
Example Question

- How would you represent an OR and AND function using a linear threshold function?
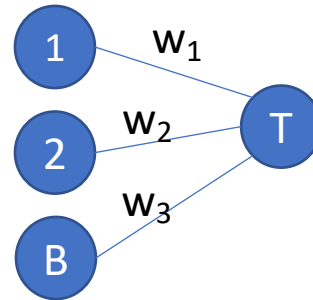
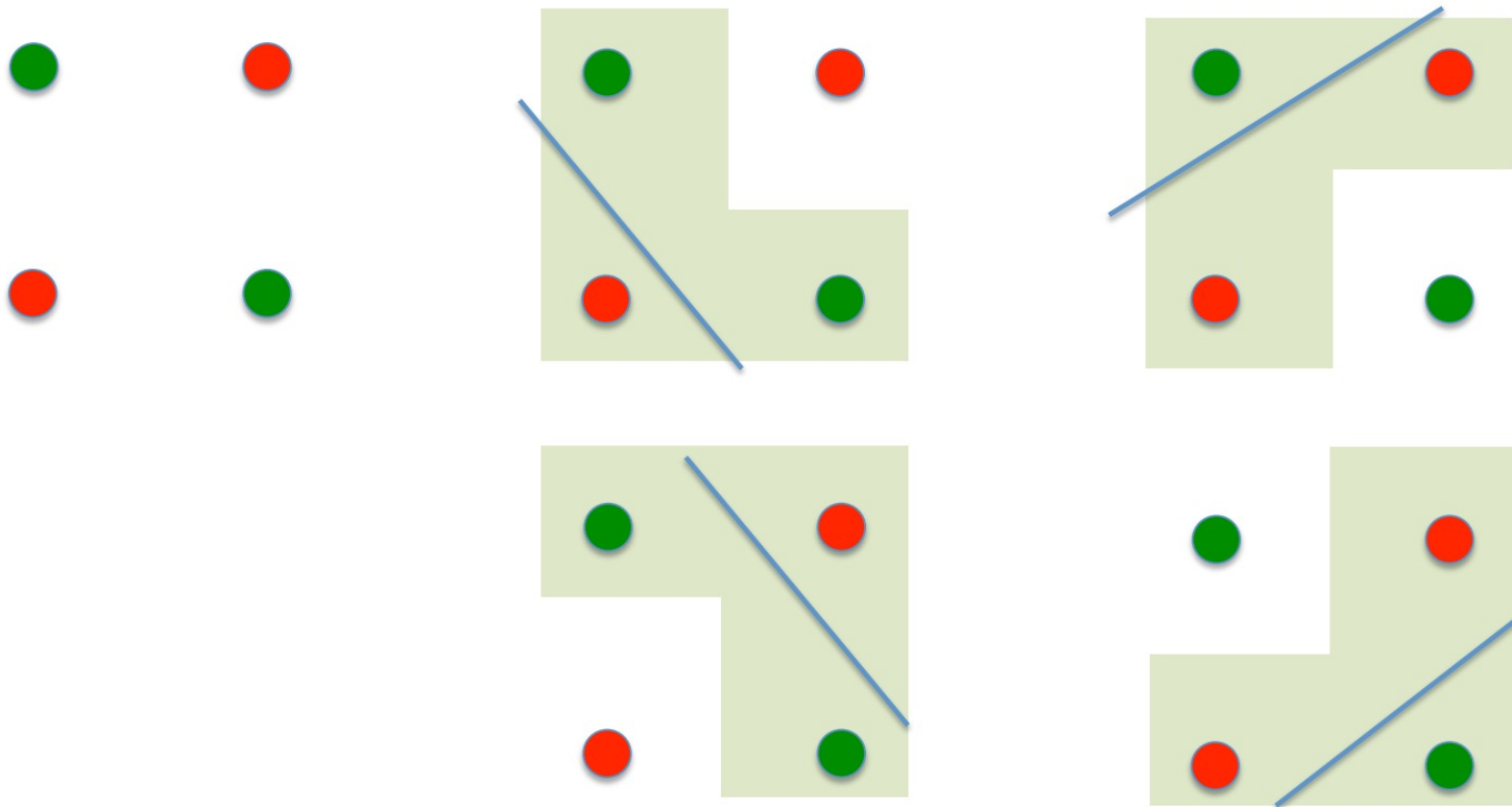- Would a perceptron be able to learn these functions?

Example Question

place points and label them s.t *perceptron will always have zero training error and non-zero leave-one-out validation error*
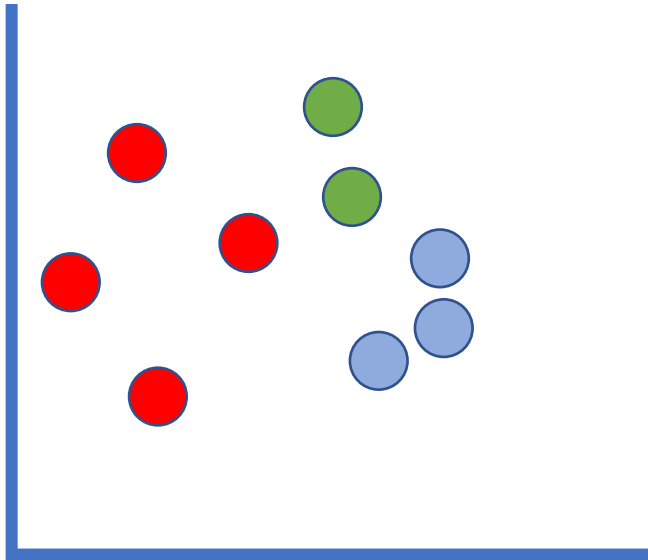
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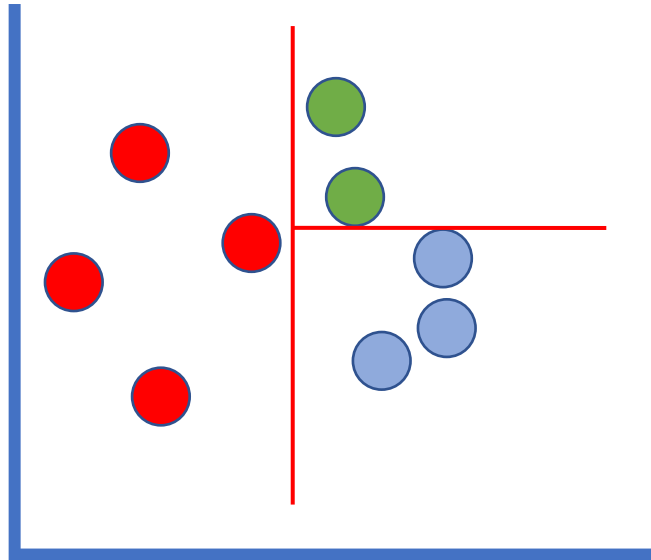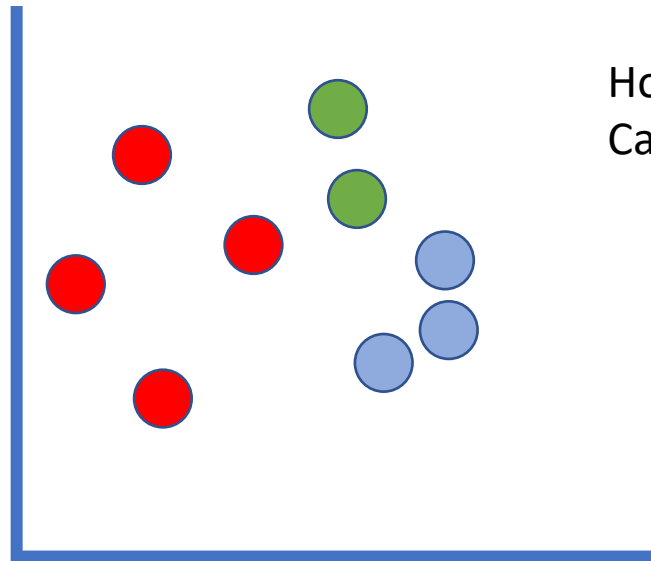
Example Questions

- What will be the result of decision tree learning vs. multi-class perceptron on this dataset?

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How would it look for Perceptron?
Can you "draw" it on the slide?