636 Midterm Review

- **Material**: Haykin chapters 1 through 5 (with focus on the material discussed in the lecture only).

- **Rules**:
  - Your ID (TAMU ID or driver's license).
  - 1 sheet of **hand-written** notes on US letter paper (use both sides). **Write your name.**
  - Scientific calculator (may not be necessary): allowed.
  - Phones and other devices: not allowed.
  - Seating: Leave one empty seat between you and your neighbor.
  - Do not sit in a desk with opposite handedness.
  - No speaking is allowed
  - Any violation you will get you kicked out.

Chapter 1: Introduction

- Benefits of neural networks

- Neural networks and brain organization

- Model neurons

- Neural network definition

- Similarity measures

Chapter 2: Learning

- Learning in general

- Five learning rules: error correction, Hebbian, memory-based, competetive, and Boltzman

- Learning paradigms: credit assignment problem, supervised and unsupervised learning.

- Memory: associative memory, correl. matrix memory, autoassociation

- Statistical nature of leanrning: bias/variance dilemma, VC dimension, PAC learning.

Chapter 3: Perceptrons and Linear Adaptive Filters

- Steepest descent

- Gauss-Newton method and linear least square fit (pseudoinverse)

- Perceptron: geometric interpretations (two ways)

- Perceptron: the role of the bias

- Linear separability and limitations of perceptron

- Perceptron learning rule

- Perceptron convergence theorem: geometric insight

Chapter 4: Multilayer Perceptrons

- Hidden unit representation

- Error gradient and backpropagation

- Momentum

- Batch vs. sequential mode

- Representational power

- Training recurrent networks with backprop

- Function approximation with backprop

- Generalization and overfitting

- Curse of dimensionality

- Virtues and limitations of backprop

Chapter 4: Multilayer Perceptrons (supplemental)

- Heuristics for better backprop

- Weight normalization

- Backprop as optimization

- Conjugate direction method

- Conjugate gradient method

Chapter 5: Radial-Basis Function Networks

- Cover's theorem

- ϕ-separability

- Exact interpolation

- Regularization theory

- Generalized RBF

- Two phases in RBF learning

- Randomly choosing RBF centers

- Learning RBF centers: self-org, supervised