Lecture 20 Outline:

1. Process of Statistical Learning Discussion Scenarios.

2. Introduction to Graphical Models.
   - Examples of Undirected Graphical Models (Markov Networks).
   - Markov Network Properties:
     (a) Basics: $\mathcal{G} = (V, E)$, vertices and edges.
     (b) Conditional dependence / independence & the global / local Markov property.

3. Gaussian Graphical Models:
   - Conditional distributions of the multivariate normal.
   - Three interpretations:
     (a) Relationship to multiple linear regression.
     (b) Relationship to inverse covariance (concentration, precision) matrix.
     (c) Relationship to partial correlation.
   - Conditional dependencies (i.e. edges) fully specified by non-zeros in the inverse covariance (multiple linear regression; partial correlations).

4. Structural Graph Learning for GGMs:
   (a) Neighborhood Selection.
      - Conditional penalized maximum likelihood estimation.
      - Min or max rule.
   (b) Penalized log-likelihood (Graphical Lasso).

   - Model and relationship to logistic regression.
   - Neighborhood selection.

6. Interpreting Graphs & Real Example.

7. Selecting Regularization Parameters.