

M339G Predictive Analytics  
University of Texas at Austin  
**Practice Problems for In-Term Exam II**  
Instructor: Milica Čudina

**Notes:** This is a closed book and closed notes exam. The maximal score on this exam is 100 points. **There are many ways in which any single problem can be solved. The solutions herein are just one possible way to tackle the given problems.**

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All written work handed in by the student is considered to be  
**their own work, prepared without unauthorized assistance.**

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**The University Code of Conduct**

"The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community. As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity."

"I agree that I have complied with the UT Honor Code during my completion of this exam."

**Signature:**

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## 2.1. CONCEPTUAL QUESTIONS.

**Problem 2.1.** (10 points) What is the difference between bagging and random forests? Which one is preferable and why?

**Problem 2.2.** (10 points) What is the crucial difference in the assumptions between LDA and QDA? What consequence does that change have on the classification criterion?

**Problem 2.3.** (10 points) Explain how naive Bayes is different from LDA. Provide one advantage which stems from this different approach. Are there disadvantages?

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**2.2. FREE RESPONSE PROBLEMS.** Please, explain carefully all your statements and assumptions. Numerical results or single-word answers without an explanation (even if they're correct) are worth 0 points.

**Problem 2.4.** (10 points) *Source: Pitman's "Probability."*

Heights and weights of a large group of people follow a bivariate normal distribution, with correlation 0.75. Of the people **at** the 90<sup>th</sup> percentile of weights, about what percentage are **above** the 90<sup>th</sup> percentile of heights?

**Problem 2.5.** (15 points) *Source: An old SRM manual.*

For a regression tree, two nodes in the tree - defining regions  $R_1$  and  $R_2$  - have the following values of the response variable (on the training set):

$$R_1 : 2, 3, 3, 4, 5$$

$$R_2 : 2, 4, 6$$

The tree is pruned using cost complexity pruning. The split creating  $R_1$  and  $R_2$  is the optimal one to prune. Determine the smallest value of  $\alpha$  for which this pruning will occur.

**Problem 2.6.** (10 points) Consider the following data set with the explanatory random variable  $X$  and the categorical response  $Y$ :

$X$	1	2	2	3	3	4	6	10	12	12
$Y$	G	B	G	G	B	B	M	B	M	M

The data are split according to the partition by  $X < 6$  and  $X \geq 6$ . What is the total (weighted) cross-entropy, Gini index, and classification error.

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### 2.3. MULTIPLE CHOICE QUESTIONS.

**Problem 2.7.** (5 points) *Source: SRM Sample Problem #29.*

Determine which of the following considerations may make decision trees preferable to other statistical methods.

- I. Decision trees are easily interpretable.
  - II. Decision trees can be displayed graphically.
  - III. Decision trees are easier to explain than linear regression models.
- (a) None.
  - (b) I and II only.
  - (c) I and III only.
  - (d) II and III only.
  - (e) The correct answer is not given above.

*Remark 2.1.* The above problems are **in addition** to your past homework assignments. Do not forget to re-solve those!