MAT 2379A
Midterm Examination

November 2, 2011 **Professor Raluca Balan**
Time: 80 minutes

Student Number:_____

Family Name: _____ **First Name:** _____

This is a closed book examination. A formula sheet and some statistical tables are included with the exam. Only TI30 and Casio calculators are permitted. Record your answer to each question in the table below.

Question	Answer
1	
2	
3	
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6	
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10	
11	
12	

NOTE: At the end of the examination, hand in only this page. You may keep the questionnaire.

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1. It is estimated that 3.3 million Canadians have diabetes. 90% of all people with diabetes have type 2 diabetes. 90% of people with type 2 diabetes are overweight. What percentage of Canadians have type 2 diabetes and are overweight? Assume that Canada has a population of 33 million people.

   A) 8.10% B) 9.45% C) 6.12% D) 4.32% E) 9.00%.

2. The following table summarizes the opinion of 119 students regarding their preference for a multiple choice exam in a statistics course, as well as their intention of pursuing medical studies:

Opinion	Number of students
prefer a multiple choice exam and intend to pursue medical studies	66
prefer a multiple choice exam and do not intend to pursue medical studies	10
do not prefer a multiple choice exam and intend to pursue medical studies	28
do not prefer a multiple choice exam and do not intend to pursue medical studies	15
Total	119

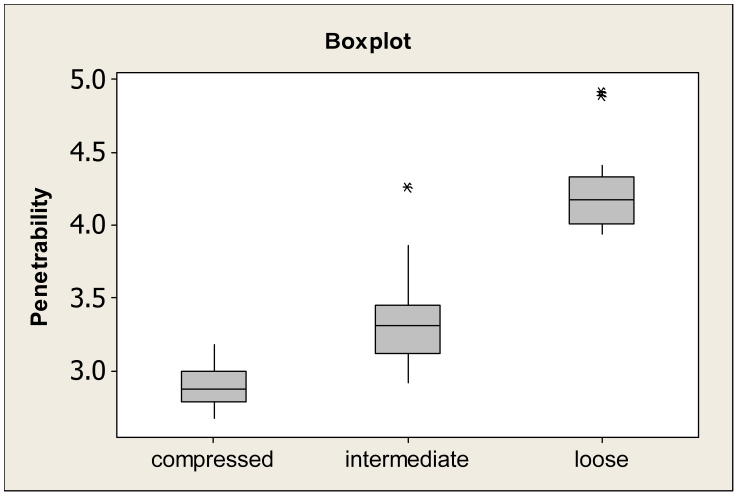
   What is the probability that a student prefers a multiple choice exam, given that he/she intends to pursue medical studies? Is the preference for a multiple choice exam independent of the intention of pursuing medical studies?

   A) 0.87, no B) 0.70, no C) 0.50, yes D) 0.45, no E) 0.25, yes

3. In a study to determine the factors associated with depression, it was found that 57% of patients suffer from insomnia, 65% are stressed and 88% are stressed or suffer from insomnia. What is the probability that a randomly selected patient in this study suffers from insomnia and is stressed?

   A) 0.45 B) 0.66 C) 0.25 D) 0.11 E) 0.34

4. Driving large farm equipment on wet soil compresses the soil. We believe that this will injure future crops. To verify this claim, we measure the penetrability at different locations at three levels of compression. (Penetrability is a measure of how much resistance plant roots will meet when they try to grow through the soil.) We produced the parallel boxplots of the penetrability measurements for the 3 levels of compression called "compressed", "intermediate" and "loose".



Choose the true statement. Only one statement is true.
A) There is an outlier in the sample of compressed soil.
B) Compression of the soil has no effect on the median of penetrability.
C) There are no outliers in the sample of intermediate compression.
D) These graphs are meaningless and should not be used to compare the penetrability for these three types of compressions.
E) The median of penetrability is largest for the loose soil, then for the intermediate, and the compressed soil has the smallest median penetrability.

5. Suppose that a spring water company fills 25% of its bottles with tap water. If you buy five water bottles from this specific company, what is the probability that at most one bottle is filled with tap water?

A) 0.3672 B) 0.3955 C) 0.6328 D) 0.6045 E) 0.0751

6. Here is a random sample of size $n = 7$ of the body mass (in grams) for spiders. The values are displayed in ascending order.

$$0.04, \quad 0.07, \quad 0.11, \quad 0.25, \quad 0.33, \quad 0.49, \quad 0.64$$

Compute the interquartile range (IQR).

A) 0.07 B) 0.42 C) 0.49 D) 0.31 E) 0.22

7. Consider the random sample of $n = 7$ body masses from Question 6. Using Minitab, we computed the sum and the sum of the squares of the body masses.

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Descriptive Statistics: body mass

           Total           Sum of
Variable   Count     Sum  Squares
body mass      7  1.9300  0.8397
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Compute the sample standard deviation of the body mass (in grams) and indicate if it is a measure of central tendency or a measure of dispersion.

A) 0.2264, measure of central tendency
B) 0.0513, measure of central tendency
C) 0.2264, measure of dispersion
D) 0.0513, measure of dispersion
E) 0.8397, measure of dispersion

8. A gallstone is a medical condition which occurs in 17% of adults. The most common symptoms of gallstones include headaches, nausea and vomiting. 86% of the patients with gallstones experience these symptoms. The same symptoms are also encountered in 15% of the patients who do not have gallstones. What is the probability that a patient has a gallstone, given that he has these symptoms?

A) 0.27 B) 0.41 C) 0.15 D) 0.54 E) 0.86

9. B-Type Natriuretic Peptine (BNP) is a substance secreted from the ventricles or lower chambers of the heart. Physicians are interested in developing a test for detecting heart failure based on high BNP levels. Compute the sensitivity and specificity of this test, using the data below which was obtained for 320 patients admitted to the emergency department of a large hospital with acute dyspnea (shortness of breath).

	High BNP level	Low BNP level
Heart failure: yes	49	6
Heart failure: no	74	191
Total	123	197

A) sensitivity=0.60; specificity=0.97 B) sensitivity=0.79; specificity=0.55
C) sensitivity=0.99; specificity=0.99 D) sensitivity=0.89; specificity=0.72
E) sensitivity=0.85; specificity=0.27

Hint: Say that a patient whose blood test indicates a high BNP level has a "positive test" result, and a patient with a low BNP level has a "negative test" result. A patient is a "true positive" if he/she has heart failure and a "true negative" otherwise.

10. The length of hospitalization of pneumonia patients is normally distributed with a mean of $\mu = 4.2$ days and standard deviation $\sigma = 0.357$ days. What is the probability that the hospital stay of a randomly chosen patient is more than 5 days?

A) 0.0125 B) 0.2500 C) 0.3945 D) 0.9875 E) 0.6055

11. Let X be a discrete random variable with the following distribution:

x	0	1	2	3	4
$P(X = x)$	0.3	0.3	0.2	0.1	0.1

Give the mean of X.

A) 2.0 B) 1.4 C) 1.0 D) 1.3 E) 1.5

12. Suppose that in a certain pediatric population, the casual sitting systolic blood pressure is normally distributed with mean $\mu = 115$ mm Hg and variance $\sigma^2 = 225$ (mm Hg)^2. Find the probability that a randomly selected child from this population has a systolic pressure between 110 mm Hg and 120 mm Hg.

    A) 0.2586 B) 0.9525 C) 0.6255 D) 0.5525 E) 0.4356