College of the Holy Cross, Spring Semester 2019
MONT 105N – Analyzing Environmental Data
Makeup Midterm Exam, March 27 and 28

Your Name: _____

Instructions   Please write your answers in the spaces provided on the following pages, and show work on the test itself. **For possible partial credit, you must show work**. Use the back of the preceding page if you need more space for scratch work.

Please do not write in the space below

Problem	Points/Poss
I	/ 30
II	/ 25
III	/ 25
Essay	/ 20
Total	/100

Do all work on these sheets. You may use the back sides if necessary. There are 100 possible points (distributed as indicated in the questions).

I. Both parts of this question deal with the data set:

$$11 \quad 9 \quad 8 \quad 11 \quad 13 \quad 10 \quad 1 \quad 8 \quad 7$$

A) (15) Find the 5-number summary, and draw the "box and whisker plot." (Use the inclusive method for the quartiles.)

B) (15) Given that the SD of this data set is $S \doteq 3.43$, how many data values are within two SD's of the mean? Is this consistent with Chebyshev's Theorem?

II. 10 balls are drawn from an urn containing 53 red and 47 black balls, *with replacement.*

A) (10) What is the probability of getting 4 red and 6 black balls in the $n = 10$ draws?

B) (10) Is your answer in A the same as the probability of tossing 4 heads and 6 tails in $n = 10$ tosses, if the coin being used is weighted so that the probability of a head is .53 and the probability of a tail is .47? Explain.

C) (5) *Given that the first 4 balls come up red,* what is the probability that the first black ball comes up on the 8th draw? (Note: This is a conditional probability.)

III. Females over 20 years old in the U.S. at present have an average height of 65 in, with $SD = 3.5$ in. The corresponding figures for males over 20 years old are 70 in and $SD = 4$ in.

A) (10) If a male over 20 years old is selected at random, what is the probability that he has height between 70 and 75 in?

B) (10) What is the probability that a female over 20 years old, selected at random, has a height between 63 and 68 in?

C) (5) (True/False and Explain): If a man and an unrelated woman were selected at random from the over 20 years old populations, it would be reasonable to compute the probability the male is between 70 and 75 in and the female is between 63 and 68 in *by multiplying your answers* from A and B.

Essay (20)

One very common everyday situation where we are given information phrased in probabilistic terms is when weather forecasts for a given geographical area include an estimated *probability of precipitation* for some time period in the future. But what does one of those probabilities mean, really? What is the exact formula used to calculate a probability of precipitation? Explain by indicating exactly what it means, for instance, if a weather forecast says there is an 80% chance of rain in Worcester tomorrow. Can it mean more than one thing? What does the National Oceanographic and Atmospheric Administration (NOAA) say about this and what is the justification they give for doing it this way? Do you think just the number gives an adequate indication to an average person? Would it help to educate people better about how these probabilities are actually computed? Is there a better way to indicate how likely certain weather conditions might be?