Student Name (PRINT):....

Student Signature:

The test consists of 10 questions.

Questions 1 through 5 are multiple-choice and worth 5 points each. Questions 6 through 10 are computational and worth 15 points each.

For questions 1 through 5, circle the correct answer $(\mathbf{a}, \mathbf{b}, \mathbf{c}, \text{ or } \mathbf{d})$ after each question. Each question is 5 points. No partial credit.

Q1 Which rules for identifying **unusual results by probabilities** are correct?

- (a) If $P(x \text{ or more}) \leq 0.05$, then x is unusually low, if $P(x \text{ or fewer}) \leq 0.05$, then x is unusually high.
- (b) If $P(x \text{ or more}) \leq 0.05$, then x is unusually high, if $P(x \text{ or fewer}) \leq 0.05$, then x is unusually low.
- (c) If $P(x) \leq 0.05$, then x is unusual.
- (d) If P(x) = 0.05, then x is unusual.

Correct answer (circle one): (a) (b) (c) (d)

Q2 What is the meaning of the 5% guideline for selections from large populations?

- (a) If the probability of an event is less than 5%, it can be ignored.
- (b) If a sample size is no more than 5% of the size of the population, treat selections with replacement as independent (even though they are technically dependent).
- (c) If a sample size is no more than 5% of the size of the population, treat selections **without replacement** as independent (even though they are technically dependent).
- (d) If a sample size is no more than 5% of the size of the population, the selections with or without replacement are always dependent.

Correct answer (circle one): (a) (b) (c) (d)

Q3 What is the meaning of the **continuity correction**?

- (a) Each whole number x in the binomial distribution is represented by the interval from x 0.5 to x + 0.5.
- (b) If the random variable is discrete, then after the correction it becomes continuous.
- (c) It allows us to apply the Central Limit Theorem for small samples $(n \leq 30)$.
- (d) If a small sample is selected from a large population, then discrete data can be treated as continuous.

Correct answer (circle one): (a) (b) (c) (d)

- Q4 What is the meaning of the **Central Limit Theorem**?
 - (a) The distribution of the sample mean \bar{x} will, as the sample size increases, approach a normal distribution.
 - (b) The distribution of the population mean μ will, as the population size increases, approach a normal distribution.
 - (c) The bell-shaped curve is symmetric about its center.
 - (d) The binomial distribution can be approximated by a normal distribution if n > 30.

Correct answer (circle one): (a) (b) (c) (d)

- <u>Q5</u> In the following list, one random variable is discrete and three others are continuous. Which one is **discrete**?
 - (a) The running time of a randomly selected movie.
 - (b) The height of a randomly selected person.
 - (c) The length (in words) of a randomly selected paragraph from a book.
 - (d) The weight of a randomly selected book.

Correct answer (circle one): (a) (b) (c) (d)

For questions 6 through 10, write your answer in the space provided. Show your work. Each question is worth 15 points.

Q6 Listed below are the numbers of English words defined on 12 pages of a dictionary:

68 49 21 55 57 61 70 42 59 50 66 99

Find the following measures for this sample (round off to <u>one</u> decimal place):

Mean = Median =

St. Deviation = Variance =

Use the range rule of thumb to find the following (do not round off): Minimal usual value = Maximal usual value =

List all unusual values in this sample:

Q7 In the accompanying table, the random variable x represents the number of soda cans per day consumed by adults.

(a) Find the mean μ and standard deviation σ of the given probability distribution. (Also, write down the corresponding formulas for μ and σ ; they are given in the tear-out card.)

x	P(x)
0	0.21
1	0.45
2	0.15
3	0.13
4	0.03
5	0.02
6	0.01

(b) Use probabilities to determine if the value x = 4 is unusual. Explain why or why not.

Q8 Assume that adults have IQ scores that are normally distributed with a mean of 90 and a standard deviation of 16. Answer the questions below by using Table A-2 or a calculator (state which method you use). Draw a diagram in each case.

(a) Find the probability that a randomly selected adult has an IQ greater than 88.

(b) Find the IQ score separating the bottom 5% from the top 95% of adults.

(c) If 16 adults are randomly selected, find the probability that their average IQ score is between 84 and 98. (Use the Central Limit Theorem.)

(d) Explain why in question (c) you can use the Central Limit Theorem.

Q9 Use the data in the following table, which summarizes blood groups and Rh types for 100 subjects:

		Group					
		Ο	А	В	AB		
Type	Rh^+	30	27	13	9	•	
	$\rm Rh^-$	12	6	2	1		

(a) If a subject is randomly selected, find the probability of getting someone who is group O and type Rh⁻.

(b) If a subject is randomly selected, find the probability of getting someone who is group O or type Rh⁻.

(c) If 2 of the 100 subjects are randomly selected without replacement, find the probability that they are both group O and type Rh^- . (Do not apply the 5% guideline. Round off to three decimal places. Show your work.)

(d) If 2 of the 100 subjects are randomly selected with replacement, find the probability that they are both group O and type Rh^- . (Do not apply the 5% guideline. Round off to three decimal places. Show your work.)

Q10 Assume that 25% of all donors have blood that is Group A. A sample of 60 donors is randomly selected. (Note: this problem is not related to Q9.)

(a) Find the mean μ and the standard deviation σ for the number of donors in the selected sample that have blood of Group A. (Keep three decimal places.)

 $\mu = \sigma =$

(b) Suppose 22 donors (out of 60) have blood of Group A. Based on the range rule of thumb, is this result unusual? Why?

In questions (c) and (d) you may use binomial probabilities or a normal approximation, whichever you prefer. Name the method you use. If you use normal approximation, draw a diagram. Round off to four decimal places.

(c) Find the probability that 15 of the selected donors have blood that is Group A.

(d - Bonus) Find the probability that at least 15 of the selected donors have blood of Group A.