MA 180/418 Midterm Test 1, Version A Spring 2010

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 (**a**, **b**, **c**, or **d**) after each question. Each question is 5 points. No partial credit.

Q1 What is the meaning of the **rare event rule** in statistics?

(a) If the probability of a particular observed event is extremely small, we adjust the probability by multiplying it by 2.

(b) If, under a given assumption, the probability of a particular observed event is extremely small, we conclude that the assumption is probably not correct.

(c) If an event is a rare event, we use the addition rule to calculate the probability; otherwise we use the multiplication rule.

(d) An event is a rare event if its probability is ≤ 0.05.

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

Q2 From the standpoint of probability, what are **independent events**?

(a) Two events are independent if the sum of their probabilities is one.

(b) Two events are independent if they have different probabilities.

(c) Two events are independent if one occurs in a first trial and the other occurs in a second trial. Selections (with or without replacement) are always independent.

(d) Two events are independent if the occurrence of one does not affect the probability of the other.

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

Q3 What is the rule for identifying an **unusually high number of successes by using probabilities**?

(a) x is an unusually high number of successes if $P(x) \leq 0.05$.

(b) x is an unusually high number of successes if $P(x \text{ or more}) \leq 0.05$.

(c) x is an unusually high number of successes if $P(x \text{ or fewer}) \leq 0.05$.

(d) x is an unusually high number of successes if $x = n$ (the number of trials).

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

Q4 Which statement must be true about **binomial distributions**?

(a) The trials of the corresponding procedure are independent and all trials have exactly the same outcome.

(b) The trials of the corresponding procedure are independent and the probability of a success is the same in all trials.

(c) The trials of the corresponding procedure have two outcomes (successes and failures) and the probability of a success is different in each trial.

(d) The corresponding random variable x (the number of successes) can have infinitely many possible values.

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

Q5 Under what circumstances could you use the **normal approximation to the binomial**?

(a) The number of trials n must be larger than 30.

(b) Either $np \geq 5$ or $nq \geq 5$ or both.

(c) Both $np \geq 5$ and $nq \geq 5$ must be satisfied.

(d) The population is normally distributed.

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

		Group			
		O	A	B	AB
Type	Rh^+	35	36	9	4
	Rh^-	8	5	1	2

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

(b) If a subject is randomly selected, find the probability of getting someone who is group A **or** type Rh^+.

(c) If 2 of the 100 subjects are randomly selected with replacement, find the probability that they are both group A and type Rh^+. (Round off to three decimal places; show your work.)

(d) If 2 of the 100 subjects are randomly selected without replacement, find the probability that they are both group A and type Rh^+. (Round off to three decimal places; show your work.)

Q7 Listed below are the numbers of English words defined on 12 pages of a dictionary:

38 31 29 33 58 30 27 36 31 37 34 40

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

Range = Midrange =

Mean = Median =

St. Deviation = Variance =

Use the range rule of thumb to find the following:

Minimal usual value = Maximal usual value =

List all unusual values in this sample:

Q8 In the accompanying table, the random variable x represents the number of cups of coffee per day consumed by adults.

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

x	$P(x)$
0	0.22
1	0.41
2	0.14
3	0.10
4	0.06
5	0.04
6	0.03

(b) Use probabilities to determine if the value $x = 5$ is unusual. Explain why or why not.

Q9 Assume that adults have IQ scores that are normally distributed with a mean of 100 and a standard deviation of 13. 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 96.

(b) Find the IQ score separating the bottom 10% from the top 90% of adults.

(c) If 9 adults are randomly selected, find the probability that their average IQ score is between 96 and 105. (Use the Central Limit Theorem.)

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

Q10 Assume that 45% of all donors have blood that is Group O. A sample of 20 donors is randomly selected. (Note: this problem is not related to Q6.)

(a) Find the probability that 6 of the selected donors have blood that is Group O. (Do not use normal approximation. Round off to four decimal places.)

(b) Find the probability that at most 6 of the selected donors have blood of Group O. (Do not use normal approximation. Round off to four decimal places.)

(c) Find the mean μ and the standard deviation σ for the number of donors in the selected sample that have blood of Group O. (Round off to one decimal place.)

$\mu =$ $\sigma =$

(Bonus) Can you use the Normal Approximation to Binomial in questions (a) and (b)? Why or why not? Explain. Then find the answers to questions (a) and (b) by using the Normal Approximation. Apply the Continuity Correction. Draw a diagram in each case.