MA 180/418 Midterm Test 1, Version A Spring 2011

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

(a) Either the original population is normal or n is larger than 30.

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

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

(d) The mean is at least 5 and the standard deviation is at least 5.

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

Q2 What is the meaning of the **rare event rule** in statistics?

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

(b) If the probability of a particular observed event is extremely small, we conclude that the event is impossible; in that case its probability must be set to zero.

(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, under a given assumption, its probability is either less than 0.05 or greater than 0.99. In both cases we conclude that the assumption is probably not correct.

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

Q3 What is the best definition for the term **Central Limit Theorem**?

(a) It means that the central value (or mean) of a standard normal distribution is 0 and the curve is symmetric.

(b) It means that a probability distribution has a central value equal to the population standard deviation divided by the square root of the sample size.

(c) It means that a sampling distribution will be normal if the original population is normally distributed, or if the sample size is greater than 30.

(d) It means that the sample size must be greater than 30 if we want the limit sample mean to be equal to the population mean.

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

Q4 Which rules for identifying **unusual results by probabilities** are correct?

(a) If $P(x) \leq 0.05$, then x is unusual.

(b) If $P(x \text{ or more}) + P(x \text{ or fewer}) \leq 0.05$, then x is unusual.

(c) If $P(x \text{ or more}) \geq 0.05$, then x is unusually high, if $P(x \text{ or fewer}) \geq 0.05$, then x is unusually low.

(d) 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.

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

Q5 What is the difference between **mean** and **median** of a set of data?

(a) The mean is the arithmetic average of the data values while the median is the average of the largest and smallest data values.

(b) The mean is the arithmetic average of the data values while the median is the middle value when the original data values are arranged in order of increasing (or decreasing) magnitude.

(c) The mean is the average of the largest and smallest data values while the median is the middle value when the original data values are arranged in order of increasing (or decreasing) magnitude.

(d) The mean is the arithmetic average of the data values while the median is the square of the mean.

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 bankruptcy filings in Dutchess County, New York State, for each month in a certain year:

38 65 91 72 56 49 44 87 68 79 40 60

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

Mean = Median =

St. Deviation = Variance =

Use the range rule of thumb to find: Minimum usual value =
Maximum usual value =

Is the value of 27 unusual? Yes or No?
Is the value of 99 unusual? Yes or No?

[Bonus] Find all quartiles and give five-number summary:

Q7 Scores on the SAT test have a mean of 1555 and a standard deviation of 312. Scores on the ACT test have a mean of 24 and a standard deviation of 4.2.

Which is relatively better: a score of 1483 on the SAT test or a score of 23 on the ACT test? Why? (Give both Z-scores and show how you compute them.)

Q8 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 technology (state which method you use). Draw a diagram in each case.

(a) Find the probability that the IQ of a randomly selected adult is at least 89.

(b) Find the IQ score separating the top 20% from the bottom 80% of adults.

(c) If 35 adults are randomly selected, find the probability that their average IQ score is between 97 and 102. (Use the Central Limit Theorem.)

(d) Give two different reasons 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			
		O	A	B	AB
Type	Rh^+	30	27	12	4
	Rh^-	11	11	5	1

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

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

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

Q10 Assume that 20% 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) Find the probability that fewer than 10 of the selected donors have blood of Group A. Use exact binomial probabilities. Round off to four decimal places.

(c) Find the probability that fewer than 10 of the selected donors have blood of Group A. Use the Normal Approximation to Binomial. (Do not forget continuity correction!) Draw a diagram. Round off to four decimal places.

(d) Find the probability that exactly 10 of the selected donors have blood that is Group A. You can use either binomial probabilities or normal approximation. For an extra credit, use *both* methods.