Quiz based on Chapter 4: Introduction to Probability   Quiz Scantron Due at beginning of class on **February 11, 2010**

4-8: In the city of Milford, applications for zoning changes go through a two-step process: a review by the planning commission and a final decision by the city council. At step 1 the planning commission reviews the zoning change request and makes a positive or negative recommendation concerning the change. At step 2 the city council reviews the planning commission's recommendation and then voted to approve or to disapprove the zoning change. Suppose the developer of an apartment complex submits an application for a zoning change. Consider the application process as an experiment. (For question 1)

1. How many sample points are there for this experiment?
    a) 3 possible outcomes
    b) 1 possible outcome
    c) 4 possible outcomes
    d) 2 possible outcomes

4-9: Simple random sampling uses a sample of size *n* from a population of size *N* to obtain data that can be used to make inferences about the characteristics of a population. Suppose that, from a population of 50 bank accounts, we want to take a random sample of four accounts in order to learn about the population. (For question 2)

2. How many different random samples of four accounts are possible?
    a) 460,600
    b) 315,200
    c) 515,300
    d) 230,300

4-12: The Powerball lottery is played twice each week in 23 states, the Virgin Islands, and the District of Colombia. To play Powerball a participant must purchase a ticket for $1 and then select five numbers from the digits 1 through 53 and a Powerball number from the digits 1 through 42. To determine the winning numbers for each game, lottery officials draw five white balls out of a drum with 53 white balls, and one red ball out of a drum with 42 red balls. To win the jackpot, a participant's numbers must match the numbers on the five white balls in any order and number on the red Powerball. In August 2001, four winners shared a jackpot of $295 million by matching the numbers 8-17-22-42-47 plus Powerball number 21. In addition to the jackpot, a variety of other prizes are awarded each time the game is played. For instance, a prize of $100,000 is paid if the participant's five numbers match the numbers on the five white balls (www.powerball.com, March 25, 2003). (For questions 3-5)

3. Compute the number of ways the first five numbers can be selected.
    a) 2,869,685
    b) 3,690,000
    c) 2,510,450
    d) 1,000,050
4. What is the probability of winning a prize of $100,000 by matching the numbers on the five white balls?
    a) 1/3690000
    b) 1/2510450
    c) 1/1000050
    d) 1/2869685
5. What is the probability of winning the Powerball jackpot?
    a) 1/150000200
    b) 1/120526770
    c) 1/152093305
    d) 1/66002755

4-14: An experiment has 4 equally likely outcomes: E1, E2, E3, and E4. (For questions 6-8)

6. What is the probability that E2 occurs?
    a) ¾
    b) 1/4
    c) 1/2
    d) 0

7. What is the probability that any two of the outcomes occur?
    a) 1/4
    b) 3/4
    c) 1/2
    d) 1

8. What is the probability that any three of the outcomes occur?
    a) 1
    b) 0
    c) 1/2
    d) 3/4

4-20: *Fortune* magazine publishes an annual issue containing information on *Fortune* 500 companies. The following data show the six states with the largest number of *Fortune* 500 companies as well as the number of companies headquartered in those states. (Fortune, April 17, 2000)

State	# companies
NY	54
CA	53
TX	45
ILL	37
Ohio	28
PENN	28

Suppose a *Fortune* 500 company is chosen for a follow-up questionnaire. What are the probabilities of the following events? (For questions 9-11)

9. Let *N* be the event the company is headquartered in NY. Find *P (N)*
    a) .108
    b) .112
    c) .450
    d) .035
10. Let *T* be the event the company is headquartered in TX. Find *P (T)*
    a) .063
    b) .094
    c) .086
    d) .090
11. Let *B* be the event the company is headquartered in one of these 6 states. Find *P (B)*
    a) .400
    b) .395
    c) .490
    d) .225

4-21: The U.S. population by age is as follows (The World Almanac 2004). The data are in millions of people.

Age	Number
19 and under	80.5
20 to 24	20.0
25 to 34	39.9
35 to 44	45.2
45 to 54	36.7
55 to 64	24.3
65 and over	35.0

Assume that a person will be randomly chosen from this population. (For questions 12-14)

12. What is the probability the person is 20 to 24 years old?
    a) .0674
    b) .0710
    c) .0770
    d) .5000
13. What is the probability the person is 20 to 34 years old?
    a) .1417
    b) .2127
    c) .2091
    d) .2909

14. What is the probability the person is 45 years or older?
    a) .3409
    b) .3445
    c) .1243
    d) .5000

4-23: Suppose that we have a sample space S = {E1, E2, E3, E4, E5, E6, E7}, where E1, E2,…, E7 denote the sample points. The following probability assignments apply: P(E1)=.05, P(E2)=.20, P(E3)=.20, P(E4)=.15, P(E5)=.15, P(E6)=.10, and P(E7)=.05. (For questions 15-18)

Let A= {E1, E4, E6}
B= {E2, E4, E7}
C= {E2, E3, E5, E7}

15. Find P (B)
    a) .50
    b) .60
    c) .40
    d) .25
16. Find P(A U B).
    a) .60
    b) .55
    c) .65
    d) .50
17. Find P(A ∩ B).
    a) .25
    b) .20
    c) .15
    d) .05
18. Are events A and C mutually exclusive?
    a) No, they are not mutually exclusive.
    b) Yes, they are mutually exclusive.
    c) Both a and b are correct.
    d) None of the above.

4-24: Clarkson University surveyed alumni to learn more about what they thought about Clarkson. One part of the survey asked respondents to indicate whether their overall experience at Clarkson fell short of expectations, met expectations, or surpassed expectations. The results showed that 3% of the respondents did not provide a response, 26% said that their experience fell short of expectations, 65% of respondents said that their experience met expectations. (For questions 19-20)

19. If we chose an alumnus at random, what is the probability that they would say their experience surpassed expectations?
    a) .65
    b) .06
    c) .05
    d) .40
20. If we chose an alumnus at random, what is the probability that he or she would say their experience met or surpassed expectations?
    a) .71
    b) .50
    c) .70
    d) .10

4-26: Data on the 30 largest stock and balanced funds provided one year and five year percentage returns for the period ending March 31, 2000. Suppose we consider a one year return in excess of 50% to be high and a five year return in excess of 300% to be high. Seven of the funds had one year returns in excess of 50%, 9 of the funds had 5 year returns in excess of 300% and four of the funds had both one year returns in excess of 50% and five year returns in excess of 300%. Let Y=high one-year return and M=high five-year return. (For questions 21-24)

21. What is the probability of a high one-year return?
    a) .30
    b) .23
    c) .27
    d) .36
22. What is the probability of a high five-year return?
    a) .36
    b) .30
    c) .17
    d) .23
23. What is the probability of both a high one-year return and a high five-year return?
    a) .70
    b) .36
    c) .13
    d) .17
24. What is the probability of neither a high one-year return nor a high five-year return?
    a) .36
    b) .64
    c) .60
    d) .23

4-28: A survey of magazine subscribers showed that 46.8% rented a car during the past 12 months for business reasons, 54% rented for personal reasons, and 25% for both. Let B=rented a car for business reasons and P=rented a car for personal reasons. (For questions 25-26)

25. What is the probability that a subscriber rented a car during the past 12 months for business or personal reasons?
    a) .54
    b) .758
    c) .698
    d) .458
26. What is the probability that a subscriber did not rent a car during the past 12 months for either personal or business reasons?
    a) .698
    b) .242
    c) .302
    d) .54

4-30: Suppose that we have two events, A and B, $P(A) = .55$, $P(B) = .65$, and $P(A \cap B) = .40$ (For questions 27-29)

27. Find $P(A|B)$
    a) .8000
    b) .6154
    c) .6667
    d) .5000
28. Find $P(B|A)$
    a) .6667
    b) .5000
    c) .7273
    d) .8000
29. Are A and B independent? Why or why not?
    a) No, because $P(A|B) \neq P(A)$.
    b) Yes, because $P(A|B) = P(A)$.
    c) Both a and b are correct.
    d) None of the above.

4-33: In a survey of MBA students, the following data were obtained on "students' first reason for applying to the school in which they were matriculated." (For questions 30-32)

	School quality	cost/convenience	other	total
Full time	423	392	75	890
Part time	405	590	44	1039
Totals	821	986	122	1929

30. If a student goes full time, what is the probability that school quality was the first reason for choosing a school?
    a) 2.11
    b) .475
    c) .473
    d) .196
31. If a student goes part time, what is the probability that school quality is the first reason for choosing a school?
    a) .386
    b) .539
    c) .231
    d) .390
32. Let A denote the event that a student is full time and let B denote the event that the student lists school quality as the first reason for applying. Are events A and B independent?
    a) Yes, they are independent.
    b) No, they are not independent.
    c) There is not enough information to determine the answer.
    d) None of the above.

4-36: Reggie Miller of the Indiana Pacers is the National Basketball Association's best career free throw shooter, making 85% of his shots. Assume that late in a basketball game, Reggie Miller is fouled and is awarded two shots. (For questions 33-34)

33. What is the probability that he will make both shots?
    a) .7921
    b) .5000
    c) .4250
    d) .7225
34. What is the probability that he will make at least one shot?
    a) .9879
    b) .2500
    c) .9775
    d) .9000

35. Which of the following statements about probability is *not* true?
    a) Probability values are always assigned on a scale from 0 to 1.
    b) Probability is a numerical measure of the likelihood that an event will occur.
    c) Probabilities can be used as measures of the degree of uncertainty.
    d) Probability can assume a negative value to indicate a very low probability.

36. Which of the following statements about sample space is *not* true?
    a) The sample space for an experiment is the set of all experimental outcomes.
    b) A sample point is an element of the sample space.
    c) An experiment involving tossing a coin and a die has a sample space made up of four sample points.
    d) An experiment involving tossing two coins has a sample space made up of four sample points.

37. Which of the following statements about combinations and permutations is *not* true?
    a) The counting rule for combinations allows one to count the number of experimental outcomes when the experiment involves selecting n objects from a set of N objects.
    b) An experiment results in more permutations than combinations for the same number of objects because every selection of n objects can be ordered in $n!$ different ways.
    c) With N=5 and n=2, the number of combinations of two objects taken out of a pool of five objects is 10.
    d) In counting combinations, the same n objects selected in a different order is considered a different experimental outcome.

38. Which of the following statements about combinations and permutations is *not* true?
    a) With N=5 and n=2, the number of combinations of two objects taken out of a pool of five objects is 10.
    b) If we label five parts as A, B, C, D, and E, the 10 combinations or experimental outcomes can be identified as AB, AC, AD, AE, BC, BD, BE, CD, CE, and DE.
    c) With N=5 and n=2, if we label five parts as A, B, C, D, and E, the 20 permutations or experimental outcomes can be identified as AB, BA, AC, CA, AD, DA, AE, EA, BC, CB, BD, DB, BE, EB, CD, DC, CE, EC, DE, and ED.
    d) The number of permutations will always be twice as many as the number as combinations for any values of N and n.

39. __________ is used to find the number of different samples of size n that can be selected, without replacement, from a population of size N.
    a) The counting rule for combinations
    b) The counting rule for permutations
    c) The counting rule for factorial
    d) A throw net

40. Which of the following statements is *not* true about the approaches most frequently used for assigning probabilities to experimental outcomes?
    a) The three approaches most frequently used are classical, relative frequency, and subjective methods.
    b) The classical method of assigning probabilities is appropriate when all the experimental outcomes are not equally likely.
    c) Using the classical method, if n experimental outcomes are possible, a probability of $1/n$ is assigned to each experimental outcome.
    d) One of the two basic requirements for assigning probabilities is that the probability assigned to each experimental outcome must be between 0 and 1, inclusively.

41. Regardless of the method used, two basic requirements for assigning probabilities must be met. Which of the following is *not* one of these two requirements?
    a) The probability assigned to each experimental outcome must be between 0 and 1, inclusively.
    b) The sum of the probabilities for all the experimental outcomes must equal 1.0.
    c) Probability of an event must never be equal to zero.

42. Which of the following statements is *not* true about events and their probabilities?
    a) In many experiments the large number of sample points makes the identification of the sample points, as well as the determination of their associated probabilities, extremely straight-forward and easy.
    b) An event is a collection of sample points.
    c) The probability of any event is equal to the sum of the probabilities of the sample points in the event.
    d) The sample space, S, is an event. Because it contains all the experimental outcomes, it has a probability of 1; $P(S)$ =1.

43. Which of the following statements is *not* true about the complement of an event?
    a) Given an event A, the complement of A is defined to be the event consisting of all sample points that are *not* in A.
    b) The probability of an event A is extremely difficult to compute if the probability of its complement, $P(A^c)$, is known.
    c) A Venn diagram can be used to illustrate the concept of a complement.
    d) When using a Venn diagram, the circle represents event A and contains only the sample points that belong to A.
    e) When using Venn diagrams, the rectangular area represents the sample space for the experiment and as such contains all possible sample points.

44. Which of the following statements is *not* true about the addition law?
    a) The primary purpose of the addition law of probability is to compute the complement of an event.
    b) The addition law helpful when one is interested in knowing the probability that at least one of two events occurs.
    c) Two concepts that are related to the addition law of probability are *union* of events and *intersection* of events.
    d) The addition law is used primarily to compute the probability of the union of two events.

45. Which of the following statements is *not* true about basic relationships of probability?
    a) Given two events A and B, the intersection of A and B is the event containing the sample points belonging to both A and B.
    b) The intersection of two events A and B is denoted by $A \cap B$.
    c) The addition law provides a way to compute the probability that event A or event B or both occur.
    d) When $P(A \cap B)$ is greater than zero, the addition law can be written as $P(A \cup B) = P(A) + P(B)$.

46. Which of the following statements is true about mutually exclusive events?
    a) Two events are said to be mutually exclusive if the events have no sample points in common.
    b) Two events A and B are mutually exclusive if $P(A \cap B) = 0$.
    c) Events A and B are mutually exclusive if, when one event occurs, the other cannot occur.
    d) All of the above statements are true about mutually exclusive events.

47. Which of the following is true about a conditional probability?
    a) A conditional probability is written as $P(A \mid B)$.
    b) The notation | is used to indicate that we are considering the probability of event A given the condition that event B has occurred.
    c) The notation $P(A \mid B)$ reads "the probability of A given B."
    d) All of the above statements are true about a conditional probability.

48. Which of the following statements is *not* true about conditional probability?
    a) Values that give the probability of the intersection of two events are called joint probabilities.
    b) Values in the margins of the joint probability table provide the probabilities of each event separately.
    c) Marginal probabilities are found by summing the joint probabilities in the corresponding row or column of the joint probability table.
    d) Conditional probabilities can be computed as the ratio of a joint probability to a marginal probability using the formula $P(A \mid B) = P(B) / P(A \cap B)$.

49. Which of the following statements is true about conditional probability?
    a) The notion of mutually exclusive events is exactly the same as the notion of independent events.
    b) When the events A and B are *not independent*, one can use the multiplication law $P(A \cap B) = P(A)P(B)$ to compute the *intersection* of two events.
    c) When the events A and B *are independent*, one can use the multiplication law $P(A \cap B) = P(A)P(B)$ to compute the *union* of two events.
    d) When the events A and B *are independent*, one can use the multiplication law $P(A \cap B) = P(A)P(B)$ to compute the *intersection* of two events.

50. Which of the following statements is true about conditional probability?
    a) Whereas the multiplication law of probability is used to compute the probability of a union of two events, the addition law is used to compute the probability of the intersection of two events.
    b) With $P(A \mid W) \neq P(A)$, we would say that events A and W are *independent* events.
    c) If the probability of event A is not changed by the existence of event W–that is $P(A \mid W) = P(A)$, we would say that events A and W are *independent* events.
    d) If $P(A \cap B) = P(A)P(B)$, then A and B are *dependent* events; if $P(A \cap B) \neq P(A)P(B)$, then A and B are *independent* events.