Sample Problems For Exam 2

Spring 2010 Compiled by Joe Kahlig

This collection of questions is intended to give an idea of different types of question that might be asked on the exam. This is not intended to represent an exam.
These question cover chapter 2 and chapter 3 in the Applied Finite Mathematics, 2^{th} edition by Tomastik and Epstein.

Video solutions can be found at this link: http://www.math.tamu.edu/∼kahlig/166WIRpage.html

1. Many U.S. license plates display a sequence of three letters followed by three digits.
   (a) In order to avoid confusion of letters with digits, some states do not use the letters I, O or Q on their license plates. How many of these license plates are possible?
   (b) Assuming that the letter combinations VET, MDZ and DPZ are reserved for disabled veterans, medical practitioners, and disabled persons respectively, and also taking the restriction in part a into account, how many license plates are possible?
2. Dripping wet after your shower, you have completely forgotten the combination of your lock. It is one of those "standard" combination locks, which uses a three number combination with each number in the range of 0 through 39. All you remember is that the second number is either 27 or 37, while the third number ends in a 5. In desperation, you decide to go through all possible combinations. Assuming that it takes about 10 seconds to try each combination, what is the longest possible time it can take to open your locker?
3. How many 4-person committees are possible from a group of 9 people if:
   (a) There are no restrictions?
   (b) Both Jim and Mary must be on the committee?
   (c) Only Jim or only Mary is on the committee?
4. The U.B.S. Television company is considering bids submitted by seven different firms for three different contracts. What is the probability that one of the firms got exactly two contracts?
5. You have a box that contains 3 red balls, 4 black balls, 2 green balls, and 5 purple balls. If you take a sample of three balls from the box,
   (a) how many ways can you get 2 black balls and one green ball?
   (b) how many ways can you get exactly 2 red balls or exactly one purple ball?
   (c) what is the probability that at least two purple balls?
6. How many different arrangements can be made from the letters of CARAVANSARY?
7. Jim has a drawer containing eight blue, five black, and six white socks. If he pulls out two socks at random, what is the probability that Jim will draw a matching pair of socks?
8. City Transit Authority is hiring 10 bus drivers. Twenty guys and 15 girls apply for the job. If it is stipulated that and equal number of men and women are to be selected (5 men and 5 women), what is the probability that Bob, Phill, and Sara are hired?
9. A student takes a 10 question multiple choice exam in which each question has 4 answers. Being unprepared for the exam, the student randomly guesses at each of the question.
   (a) What is the probability of getting exactly 6 of the questions correct?
   (b) What is the probability of passing the exam? (Grades below 70 don't pass.)

(c) What is the probability that the student get the first three correct and the last 7 wrong?

(d) How many questions should the student expect to get correct?

10. Fifteen people are selected at random. What is the probability that

(a) at least 2 of the people in this group were born on the same day?

(b) at least 2 of the people in this group were born in the same month? Assume that months are equally likely.

(c) exactly four of the people in the group were born in the month of July?

11. Classify the following random variables as finite discrete, infinite discrete, or continuous.

(a) X = The number of times a die is cast until a 5 is rolled.

(b) X = How long it takes you use an ATM machine.

(c) X = The number of cadets in a class of 100 students.

(d) X = The temperature of the human body.

12. The accompanying data were obtained in a study conducted by the management of the Sav-More Supermarket. In this study the number of customers waiting in line at the express checkout at the beginning of each 3-minute interval between 9 a.m. and 12 noon on Saturday was observed.

Number of Customers	0	1	2	3	4	5	6	7	8	9	10
Frequency	1	4	2	7	14	8	10	6	3	4	1

(a) Find the probability distribution for the random variable X, where X denotes the number of customers observed waiting in line.

(b) Draw a probability histogram. Be sure to label the picture.

(c) $P(2 \leq X \leq 6) =$

(d) $P(X \leq 8) =$

(e) Find the number of people that we would expect to be in line at any given time on Saturday.

(f) Compute the mean, median, mode, variance, and standard deviation for the frequency chart. Be sure to label the answers.

13. Fred wants to purchase a 10-year term life insurance policy that will pay the beneficiary $100,000 in the event that Fred doesn't survive the next ten years. Using life insurance tables, he determines that the probability that he will live another ten years is .97. What is the minimum amount that he can expect to pay for his premium?

14. Suppose you roll two fair six sided dice and sum the numbers that show. You win twice what you paid if a 7 or 11 shows up. You lose what you paid if a 2,3, or 12 shows up. For anything else that shows up, you win $5. The game costs $10 to play. Let X be the net winnings.

(a) What is the expected net winnings?

(b) How much should be charged to make this a fair game?

15. An insurance company estimates that 8% of automobile owners do not carry liability insurance. If 60 cars are stopped at random,

(a) What is the probability that less than 10% of them have no liability insurance?

(b) Of the 60 cars stopped, how many would we expect to have no liability insurance?

(c) What is the standard deviation for this problem?

(d) What is the variance?

16. A random variable, X, has a mean of 125 and a standard deviation of 10. Find $P(111 \leq X \leq 139)$.

17. The random variable X has a mean of 53 and a standard deviation of 8. Use Chebyshev's inequality to find the probability that X is greater than 63 or X is less than 43.

18. The amount of time between taking a pain reliever and getting relief is normally distributed with a mean of 23 minutes and a standard deviation of 4 minutes. Find the probability that the time between taking the medication and getting relief is as follows.

    (a) at least 30 minutes.

    (b) at most 20 minutes.

    (c) exactly 20 minutes.

    (d) at most 30 minutes and more than 20 minutes.

19. The time it takes an employee to package the components of a certain product is normally distributed with $\mu = 8.5$ minutes and $\sigma = 1.5$ minutes. As an incentive, management has decided to give special training to the 34% of employees who took the greatest amount of time to package the components. What is the longest amount of time that you can take and not have to attend the special training course?

20. The lifespan of a 60 watt light bulb is normally distributed with an average lifespan of 8,000 hours and a standard deviation of 15 days.

    (a) What is the probably that a bulb selected at random will last at least 8,250 hours?

    (b) If 4 light bulbs are selected at random, what is the probability that all of the bulbs will last at least 8,250 hours?

    (c) Approximately how many bulbs in a shipment of 400 would last at least 8,250 hours?

21. If Z is normally distributed, compute
    $P(-2 \leq Z < 1) =$

22. If X is a normally distributed random variable with mean of 43 and variance 64, find the value of A such that $P(38 < X < A) = 0.425$