***Problems for practice: Mathematical expectation***

1. The following table contains the probability distribution of the number of traffic accidents daily in a small city.

Accidents daily(X): 0 1 2 3 4 5

P(X): 0.10 0.20 0.45 0.15 0.05 0.05

Compute

* 1. the mean or expected number of accidents per day
  2. The variance of the distribution.

1. You are trying to develop a strategy for investing in two different stocks. The anticipated annual return for a $1,000 investment in each stock has the following probability distribution.

|  |  |  |
| --- | --- | --- |
| Probability | Stock X | Stock Y |
| 0.1  0.3  0.3  0.3 | -$100  0  80  150 | $50  150  -20  -100 |

Compute the

* + 1. Expected return for stock X
    2. Expected return for stock Y
    3. Standard deviation for stock X
    4. Standard deviation for stock Y
    5. Which investment stocks X or Y do you prefer? Why?

***Problems for practice: Binomial Distribution***

1. Determine the following
   1. If n = 4 and p =0.12, then what is P(X= 2)
   2. If n = 10 and p =0.40, then what is P(X= 0)
2. At a particular university it has been found that 20% of the students withdraw without completing the Business Statistics Course. Assume that 18 students have registered for the course this semester.
3. What is the probability that at least one will withdraw?
4. What is the probability that at most 2 will withdraw?
5. What is the probability that none will withdraw?
6. Determine the mean and standard deviation of the random variable X in each of the following binomial distributions:
   * 1. If n = 4 and p = 0.10
     2. If n = 4 and p = 0.40
7. The latest nationwide political pool indicate that for Americans who are randomly selected, the probability that they are conservative is 0.55, the prob. that they are liberal is 0.30 and the probability that they are middle of the road is 0.15. Assuming that these probabilities are accurate, answer the following questions. Pertaining to a randomly chosen group of 10 Americans.
   * 1. What is the probability that four are liberal? **Answer 0.2001**
     2. What is probability that none are conservative? **Answer 0.0003**
     3. What is the probability that two are middle of the road? **Answer 0.2759**
     4. What is the probability that at least eight are liberal? **Answer 0.0016**
8. The wall street journal reported some interesting statistics on the job market. One statistic is that 40% of all workers say they would change job for "slightly higher pay". In addition, 88% of companies say that there is a shortage of qualified job candidates. Suppose 16 workers are randomly selected and asked if they would change job for slightly higher pay. What is the probability that nine or more say yes? What is the probability that three, four, five or more say yes? If 13 companies are contacted, what is the probability that exactly 10 say there is a shortage of qualified job candidates? What is the probability that all of the companies say there is a shortage of qualified job candidates? What is the expected number of companies that would say there is a shortage of qualified job candidates?
9. A commercial jet aircraft has four engines. For an aircraft in flight to land safely, at least two engines should be in working condition. Each engine has an independent reliability of 90%. What is the probability that an aircraft in flight can land safely?

***Problems for practice: Poisson distribution***

1. Given λ= 4.2, for a Poisson distribution, find
   1. P(x = 0) b. p( x= 1) c. p( x = 2) d. p( x > 2)
2. A pen company averages 1.2 defective pens per carton (200 pens). The number of defect per carton is Poisson distributed.
   1. What is the probability of selecting a carton having no defective pens?
   2. What is the probability of findings eight or more defective pens in a carton?
   3. Suppose a purchaser of these pens will quit buying from the company if a carton contains more than three defective pens. What is the probability that a carton contains more than three defective pens?
3. The average number of claims per hour made to the Gnecco and Trust Insurance Company for damages or losses incurred in moving is 3.1. What is the probability that in any given hour
4. Fewer than three claims will be made?
5. Exactly three claims will be made?
6. Three or more claims will be made?
7. More than three claims will be made?
8. On Monday mornings, the first national bank only has one teller window open for deposits and withdrawal. Experience has shown that the average number of arriving customers in a 4-minute interval on Monday morning is 2.8, and each teller can serve more than that number efficiently. These random arrivals at this bank on Monday morning are Poisson distributed.
   1. What is the probability that on a Monday morning exactly six customers will arrive in a 4-minute intervals?
   2. What is the probability that no one will arrive at the bank to make a deposit or withdrawal during 4-minute interval?
   3. Suppose the teller can serve no more than four customers in any 4-minute interval at this window on a Monday morning. What is probability that, during any given 4-minute interval, the teller will be unable to meet the demand? What is the probability that the teller will be able to meet the demand? When demand cannot be met during any given interval, a second window is opened. What percentage of the time will a second window have to be opened?
   4. What is the probability that exactly three people will arrive at the bank during 2-minute period on Monday morning to make a deposit or a withdrawal? What is the probability that five or more customers will arrive during 8-minute interval?
9. Airline passengers arrive randomly and independently at the passenger screening facility at a major international airport. The average arrival rate is 6 passengers per minute**.**
10. What is probability that more than three passengers will arrive in a minute?
11. What is the probability that three or four passengers arrive in a minute?
12. What is the probability that exactly one passenger arrive in a minute?
13. What is the probability that at least two passengers arrive in a minute?
14. What is the probability that exactly one passenger will arrive in two minutes?
15. What is the probability that at least two passengers arrive in two minutes?

***Poisson approximation to Binomial distribution:***

1. Given a binomial distribution with n = 30 trails and p = 0.04, use the Poisson approximation to the binomial to find

a. P(r = 5) b. P (r= 3) c. P(r = 7)

1. The Orange county Dispute settlement center handles various kinds of disputes but most are marital disputes. In fact 96 percent of the disputes handled by the DSC are of a marital nature.
2. What is the probability that, out of 80 disputes handled by the DSC, exactly seven are non-marital?
3. None are non marital?
4. Nepal Rastra bank is responsible for printing the country’s paper money. It has an impressively small printing error only 0.5 percent of all bills are too flawed for circulation. What is the probability that out of a batch of 1000 bills,
   1. None are too flawed for circulation.
   2. Ten are too flawed for circulation.
   3. Six are too flawed for circulation.

***Problems for practice: Hyper-geometric Distribution***

1. Compute the following probabilities by using the hpergeomestric formula.
   1. The probability of x = 3 if N = 11, A = 8 and n = 4
   2. The probability of x < 2 if N = 15, A = 5 and n = 6
   3. The probability of x = 0 if N = 9, A = 2 and n = 3
2. Out of top 19 companies in the world in terms of oil refining capacity. Eleven companies are privately owned and others are state owned. Suppose six companies are randomly selected.
   1. What is the probability that exactly one company is privately owned?
   2. What is the probability that exactly four companies are privately owned?
   3. What is the probability that all six companies are privately owned?
   4. What is the probability that none of the companies are privately owned?
3. A company produces and ships 16 personal computers knowing that four of them have defective wiring. The company that purchased the computers is going to thoroughly test three of the computers. The purchasing company can detect the defective wiring. What is the probability that the purchasing company will find the following?
   * + 1. No defective computers
       2. Exactly three defective computers
       3. Two or more defective computers
       4. One or fewer defective computers
4. Catalog age lists the top 17 U.S. firms in annual catalog sales. Dell computer is number one followed by Gateway and J.C. Penney. Of the 17 firms on the list, eight are in some type of computer-related business. suppose four firms are randomly selected
5. What is the probability that none of the firms are in some type of computer-related business?
6. What is the probability that all firms are in some type of computer-related business?
7. What is the probability that exactly two are in non-computer-related business?