Chapter 4

1. $P(A) = 0.35$; $P(B) = 0.50$ and $P(A \cap B) = 0.20$

    a. Find $P(A \cup B)$; $P(A | B)$; $P(B | A)$; are A & B independent?;

    b. $P(A')$; $P(B')$; $P(A' | B)$

2. $P(A) = 0.70$; $P(B) = 0.40$ and A & B are independent.

    a. Find $P(A \cap B)$; $P(A \text{ or } B)$; $P(A | B)$; $P(A \cap B)$; $P(A \cup B)$;

3. $P(A) = 0.70$; $P(A | B) = 0.40$; $P(B) = 0.50$

    a) $P(A \cap B)$; $P(A \cup B)$; are A and B independent?

4. $P(A) = 0.30$; $P(B) = 0.60$ and A and B are mutually exclusive.

    a) $P(A \cap B)$; b) $P(A \cup B)$; c) $P(A | B)$

5. Suppose that you roll a die 2 times.

a) Find the number of possible outcomes and list them.
b) What is the probability that the first die is 3; and the second die is 4?
c) What is the probability that you get one 3 and one 4?
d) What is the probability that their sum is more than 9?

6. Suppose that you toss a fair coin 3 times.

a) List all possible outcomes.
b) What is the probability that all three are tails?
c) What is the probability that only one of them is Head?
d) What is the probability that at least one of them is Head?

7. If there are 3 different roads between the cities A and B ; and 5 different roads between the cities B and C ; how many different ways can you go from A to C?

8. There are 6 doctors and 8 nurses in a clinic.

a) How many different ways can you choose 2 doctors?
b) How many different ways can you choose 3 Nurses?
c) How many different ways can you choose 2 doctors and 3 nurses?
d) If the specialist nurse Mrs. X has to be in the Group of 3 Nurses, in how many different ways you can choose 2 doctors and 3 nurses?
e) If you randomly choose 5 persons, what is the probability that there are 2 doctors and 3 nurses?

9. If 5 friends (A, B, C, D, E) sit in a row ;

a) How many different ways can they sit?
b) How many different ways can they sit such that A sits next to D?
c) How many different ways can they sit such that A & D do not sit next to each other?

10.

	Math	Econ	Stat
Girls	20	40	30
Boys	15	50	25

Find the probability that a randomly selected student

a) Takes Stat?
b) Takes Math or Econ?
c) Takes Econ and Girl?
d) Takes Econ if the student is a Boy?
e) Does not take Econ?
f) Is a boy and does not take Stat?

11. Assume that people come to a movie on time or late. If a person comes the movie on time, there is 80% chance that he will like the movie. If he comes late, there is 40% chance that he will not like the movie. If 30% people are late based on History; Find

a. Percentage of people liked movie.
b. The probability that a random person was late given that he liked the movie.
c. The probability that a random person was late and did not like the movie.

12. A study was recently done that emphasized the problem we all face with drinking and driving. Four hundred accidents that occurred on a Saturday night were analyzed. Two items noted were the number of vehicles involved and whether alcohol played a role in the accident. The numbers are shown below:

Did alcohol play a	Number of Vehicles			
	1	2	3	Totals
Yes	50	100	20	170
No	25	175	30	230
Totals	75	275	50	400

a. Referring to Table above, what proportion of accidents involved more than one vehicle?

b. Referring to Table above, what proportion of accidents involved alcohol and a single vehicle?

c. Referring to Table above, what proportion of accidents involved alcohol or a single vehicle?

13. At a Texas college, 60% of the students are from the southern part of the state, 30% are from the northern part of the state, and the remaining 10% are from out-of-state. All students must take and pass an Entry Level Math (ELM) test. 60% of the southerners have passed the ELM, 70% of the northerners have passed the ELM, and 90% of the out-of-staters have passed the ELM.

    a. What is the probability that a randomly selected student is someone from northern Texas who has not passed the ELM.

    b. What is the probability that a randomly selected student has passed the ELM.

    c. If a randomly selected student has not passed the ELM, what is the probability that the student is from southern Texas is.

14. An exploration team of 2 women and 3 men is to be chosen from a candidate pool of 6 women and 7 men. How many different ways can this team of 5 be formed?

15. There are 10 finalists at a national dog show. How many different orders of finishing can there be for all the 10 finalists?

16. A survey conducted by the Segal Company of New York found that in a sample of **189 large** companies, 40 offered stock options to their board members as part of their compensation packages. For **small** companies, **43 of the 180** surveyed indicated that they offer stock options as part of their compensation packages to their board members.

    a) Complete the following contingency table.

		Company Size		Total
		Large	Small	
Stock Options	Yes		43	
	No			
Total		189		369

    b) Referring to the contingency table, what is the probability that the company offered stock options to their board members?

    c) Referring to the contingency table, what is the probability that the company is small or offered stock options to their board members?

d) Referring to the contingency table, given that a randomly selected company is a large company, what is the probability that it offered stock options to their board members?

17. A company has 2 machines that produce widgets. An older machine produces 23% defective widgets, while the new machine produces only 8% defective widgets. In addition, the new machine produces 75% of the widgets and the older machine produces the remaining.

a) Given that a widget was produced by the new machine, what is the probability it is not defective?
b) What is the probability that a randomly chosen widget produced by the company is defective?

18. An exploration team of 2 women and 3 men is to be chosen from a candidate pool of 6 women and 7 men. How many different ways can this team of 5 be formed?

19. There are only 4 empty rooms available in a student dormitory for eleven new freshmen. Each room is considered unique so that it matters who is being assigned to which room. How many different ways can those 4 empty rooms be filled one student per room?

20. A sample of 300 adults is selected. The contingency table below shows their registration status and their preferred source of information on current events. If an adult is selected at random,

		Preferred source of information			
		Television	Newspapers	Radio	Internet
Voting registration status	Registered	45	30	45	36
	Not registered	35	44	45	20

a. What is the probability that he/she prefers to get his/her current information from the Internet?
b. What is the probability that he/she is a registered voter?
c. What is the probability that he/she is a registered voter and prefers to get his/her current information from the television?
d. If an adult is selected at random, what is the probability that he/she is a registered voter given that he/she does not prefer to get his/her current information from the Internet?

21. Suppose that patrons of a restaurant were asked whether they preferred water or whether they preferred soda (S). 70% of the patrons are males. 15% of the females (F) preferred soda. 80% of the males (M) preferred water (W) (Hint: you may use decision tree).

a. Find the probability that a randomly selected patron prefers soda **P (S)**.

b. Given that we randomly selected patron who prefers water, find the probability that he is a male **P (M/W)**.

22. A high school debate team of 4 is to be chosen from a class of 20. How many possible ways can the team be formed?

23. The amount of time required for an oil and filter change on an automobile is **normally** distributed with a mean of 45 minutes and a standard deviation of 10 minutes. A **random sample of 16** cars is selected.

a. What would you expect the standard error of the mean to be?

b. What is the probability that the sample mean is between 45 and 52 minutes?

Chapter 5

1. Consider the following probability distribution

X	P(X)
2	0.2
7	0.3
9	0.5

a) Find the expected value of X, E (X)
b) Find the Variance of X
c) P (X ≥ 3)

2. Let X be the number of tails when you toss a coin 3 times. a) Write the probability distribution of X. b) Find mean and variance of X. c) P (X ≥ 2)

3.

Prob	Sales	Price
0.2	10	8
0.5	20	7
0.3	30	3

Find the correlation between Sales & Price and Comment on the strength of linear relationship

4. Suppose that mean and variance of X & Y are given as below and covariance between X and Y = cov (X,Y)= – 10

	X	Y
Mean	3	4
Variance	9	25

a. Find E (X + Y) ; standard deviation of (X + Y)
b. Let P = 0.3 X + 0.7Y
c. Find E (P); and standard deviation of P

5. Suppose that there are 15 multiple choice questions. Each question has 5 choices and only 1 of the choices is correct If a student randomly answers the questions, find the probability that
a. Exactly 3 questions are correct
b. At least 3 questions are correct
c. Only 6 are incorrect
d. Expected number of correct questions, and the variance of correct questions.
e. If each question worths 6 point, what is the expected score.

6. Suppose that you toss a biased coin 8 times. If the probability of " Head" is 0.4 find the probability that

    a. At most 2 of them are Heads.
    b. More than 6 are heads
    c. No more than 2 are heads
    d. Only 5 of them are Tails
    e. least 6 Tails

7. A box contains 10 bulbs and it is accepted if at most one bulb is defective. A bulb is defective with probability 0.15

    a. What is the probability that a random box will be accepted?
    b. If a customer buys two boxes, what is the probability that he will accept both of them?
    c. A store orders 12 boxes. What is the probability that they will accept at least 2 of them

8) On average, 3.2 accidents happen on road 13 per week. What is the probability that.

    a. 3 accidents will happen next week?
    b. 4 accidents will happen in the next 14 days?
    c. At most 2 Accidents will happen next week?
    d. More than 2 accidents will happen in next week?
    e. Standard Deviation of number of accidents per week, per two weeks?

9) A Salesman sells on average 4 cars per week (during the weekdays: Sun-Thu). What is the probability that he will sell

    a. Some cars
    b. 2 or more cars but less than 5
    c. 2 cars on Tuesday

10) 150 vehicles pass through bridge XYX per hour.

    a. Find the probability that none passes in a given minute.
    b. What is the expected number of vehicles passing the bridge in 5 minutes?
    c. Find the probability that 20 vehicles pass in 10 minutes.

11. The probability that a particular type of smoke alarm will function properly and sound an alarm in the presence of smoke is 0.8. You have 2 such alarms in your home and they operate independently (Binomial). Find
    a. The probability that both smoke alarms sound an alarm in the presence of smoke

b. The probability that neither sound an alarm in the presence of smoke

12. The number of 911 calls in Butte, Montana, has a Poisson distribution with a mean of 10 calls a day (Poisson). Find
    a. The probability of seven or eight 911 calls in a day
    b. The probability of 2 or more 911 calls in a day

13. The probability that a particular type of smoke alarm will function properly and sound an alarm in the presence of smoke is 0.45. You have 5 such alarms in your home and they operate independently (**Binomial**). Find

    a. The probability that there is No smoke alarms.
    b. The probability that there is at least one smoke alarm.
    c. The probability that there are no more than four smoke alarms.

14. The number of 911 calls in Washington DC, has a **Poisson** distribution with a mean of 8 calls a day (**Poisson**). Find

    a. The probability of eight 911 calls in a day
    b. The probability of at most two 911 calls in a day
    c. The probability of some 911 calls in a day

15. The number of power outages at a nuclear power plant has a **Poisson** distribution with a mean of 6 outages per year.
    a. Find the probability that there will be **exactly** 3 power outages in a year
    b. Find the probability that there will be **at least** 3 power outages in a year
    c. Find the probability that there will be **at least** 1 power outage in a year
    d. Find the probability that there will be **no more** than 1 power outage in a year

16. The Department of Commerce in a particular state has determined that the number of small businesses that declare bankruptcy per month is approximately a **Poisson** distribution with a mean of 6.4.

    a. Find the probability that **more** than 3 bankruptcies occur next month.
    b. Find the probability that **exactly** 5 bankruptcies occur next month.

17. The on-line access computer service industry is growing at an extraordinary rate. Current estimates suggest that only 20% of the home-based computers have access to on-line services. This number is expected to grow quickly over the next 5 years. Suppose 7 people with home-based computers were randomly and independently sampled.

    a. Find the probability that **fewer** than 3 of those sampled currently have access to on-line services.

b. Find the probability that **more** than 6 of those sampled currently **DO NOT** have access to on-line services.

18. A certain type of new business succeeds 60% of the time. Suppose that 3 such businesses open (where they do not compete with each other, so it is reasonable to believe that their relative successes would be independent).

   a. Find the probability that all 3 businesses succeed.
   b. Find the probability that all 3 businesses fail.
   c. Find the probability that at least 1 business succeeds.
   d. Find the probability that exactly 1 business succeeds.

19. Sixty percent of the applicants who are applying for a certain job in a company are accepted. Assuming a **binomial** probability distribution model, what is the probability that among the next 10 applicants
   a. Exactly 5 will be accepted?
   b. Exactly 3 will be rejected?
   c. Determine the expected number of acceptances.
   d. Compute the standard deviation.

20. A life insurance company has determined that each week an average of seven claims is filed in its Nashville branch. Assume a **Poisson** probability distribution model to answer the following questions.
   a. What is the probability that during the next week exactly seven claims will be filed?
   b. What is the probability that during the next week no claims will be filed?
   c. What is the probability that during the next week fewer than four claims will be filed?

21. A multiple choice test has 6 questions, and each has five possible answers, of which one is correct. If a student guesses on every question, assuming a **binomial** probability distribution model. Given that probability of the event of interest which is getting a right answer is 0.2
   a. Find the probability of getting exactly 3 correct answers in the test.
   b. Find the probability of getting at least 2 correct answers in the test.
   c. Determine the expected number of correct answers and compute the standard deviation.

22. The number of calls received by a car towing service in an hour has a **Poisson** distribution with parameter $\lambda = 1.33$. Let X denotes the number of calls received by the service in a randomly selected hour.
   a. What is the probability that the car towing service will receive exactly 3 calls in an hour?
   b. What is the probability that the car towing service will receive no calls in an hour?
   c. What is the probability that the car towing service will receive fewer than two calls in an hour?