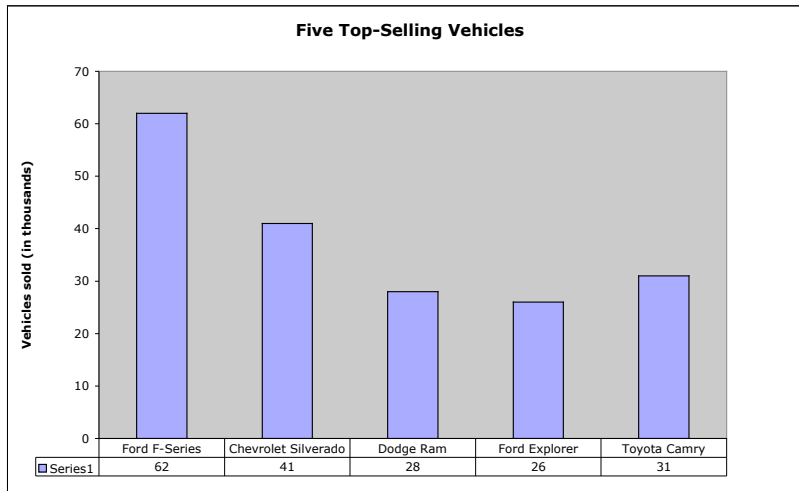


WORKSHEET – Extra examples

(Chapter 1: sections 1.1,1.2,1.3)

1. Identify the population and the sample:
 - a) A survey of 1353 American households found that 18% of the households own a computer.
 - b) A recent survey of 2625 elementary school children found that 28% of the children could be classified obese.
 - c) The average weight of every sixth person entering the mall within 3 hour period was 146 lb.
2. Determine whether the numerical value is a parameter or a statistics (and explain):
 - a) A recent survey by the alumni of a major university indicated that the average salary of 10,000 of its 300,000 graduates was 125,000.
 - b) The average salary of all assembly-line employees at a certain car manufacturer is \$33,000.
 - c) The average late fee for 360 credit card holders was found to be \$56.75.
3. For the studies described, identify the population, sample, population parameters, and sample statistics:
 - a) In a USA Today Internet poll, readers responded voluntarily to the question “Do you consume at least one caffeinated beverage every day?”
 - b) Astronomers typically determine the distance to galaxy (a galaxy is a huge collection of billions of stars) by measuring the distances to just a few stars within it and taking the mean (average) of these distance measurements.
4. Identify whether the statement describes inferential statistics or descriptive statistics:
 - a) The average age of the students in a statistics class is 21 years.
 - b) The chances of winning the California Lottery are one chance in twenty-two million.
 - c) There is a relationship between smoking cigarettes and getting emphysema.
 - d) From past figures, it is predicted that 39% of the registered voters in California will vote in the June primary.
5. Determine whether the data are qualitative or quantitative:
 - a) the colors of automobiles on a used car lot
 - b) the numbers on the shirts of a girl’s soccer team
 - c) the number of seats in a movie theater
 - d) a list of house numbers on your street
 - e) the ages of a sample of 350 employees of a large hospital
6. Identify the data set’s level of measurement (nominal, ordinal, interval, ratio):
 - a) hair color of women on a high school tennis team
 - b) numbers on the shirts of a girl’s soccer team

- c) ages of students in a statistics class
- d) temperatures of 22 selected refrigerators
- e) number of milligrams of tar in 28 cigarettes
- f) number of pages in your statistics book
- g) marriage status of the faculty at the local community college
- h) list of 1247 social security numbers
- i) the ratings of a movie ranging from “poor” to “good” to “excellent”
- j) the final grades (A,B,C,D, and F) for students in a chemistry class
- k) the annual salaries for all teachers in Utah
- l) list of zip codes for Chicago
- m) the nationalities listed in a recent survey
- n) the amount of fat (in grams) in 44 cookies
- o) the data listed on the horizontal axis in the graph



7. Decide which method of data collection you would use to collect data for the study (observational study, experiment, simulation, or survey):
- a) A study of the salaries of college professors in a particular state
 - b) A study where a political pollster wishes to determine if his candidate is leading in the polls
 - c) A study where you would like to determine the chance getting three girls in a family of three children
 - d) A study of the effects of a fertilizer on a soybean crop
 - e) A study of the effect of koalas on Florida ecosystem
8. Identify the sampling technique used (random, cluster, stratified, convenience, systematic):
- a) Every fifth person boarding a plane is searched thoroughly.
 - b) At a local community College, five math classes are randomly selected out of 20 and all of the students from each class are interviewed.
 - c) A researcher randomly selects and interviews fifty male and fifty female teachers.
 - d) A researcher for an airline interviews all of the passengers on five randomly selected flights.
 - e) Based on 12,500 responses from 42,000 surveys sent to its alumni, a major university estimated that the annual salary of its alumni was 92,500.

- f) A community college student interviews everyone in a biology class to determine the percentage of students that own a car.
- g) A market researcher randomly selects 200 drivers under 35 years of age and 100 drivers over 35 years of age.
- h) All of the teachers from 85 randomly selected nation's middle schools were interviewed.
- i) To avoid working late, the quality control manager inspects the last 10 items produced that day.
- j) The names of 70 contestants are written on 70 cards, The cards are placed in a bag, and three names are picked from the bag.

9. Explain what bias there is in a study done entirely online.

10. A local newspaper ran a survey by asking, "Do you support the development of a weapon that could kill millions of innocent people?" Determine whether the survey questions is biased and why.

SOLUTIONS:

1. a) population: all American households
sample: collection of 1353 American households surveyed
b) population: all elementary school children
sample: collection of 2625 elementary school children surveyed
c) population: all people entering the mall within the assigned 3 hour period
sample: every 6th person entering the mall within the 3 hour period
2. a) statistic – part of 300,000 graduates are surveyed
b) parameter – all assembly-line employees were included in the study
c) statistic – 360 credit cards were examined (not all)
3. a) population: all readers of USA Today; sample: volunteers that responded to the survey; population parameter: percent who have at least one caffeinated drink among all readers of USA Today; sample statistic: percent who have at least one caffeinated drink among those who responded to the survey
b) population: all stars in the galaxy; sample: the few stars selected for measurements; population parameter: mean (average) of distances between all stars and Earth; sample statistics: mean of distances between the stars in the sample and Earth
4. a) descriptive
b) inferential
c) inferential
d) inferential
5. a) qualitative
b) qualitative
c) quantitative
d) qualitative
e) quantitative
6. a) nominal
b) nominal
c) ratio
d) interval
e) ratio
f) ratio
g) nominal
h) nominal
I) ordinal
j) ordinal
k) ratio
l) nominal
m) nominal
n) ratio
o) ratio
8. systematic
cluster
stratified
cluster
random
convenience
stratified
cluster
convenience
random
7. a) survey
b) observation
c) simulation
d) experiment
e) simulation
9. It is limited to people with computers.
10. Yes – it tends to encourage negative responses.

2.1 Frequency Distributions and Their Graphs

Example 1:

The following data set lists the midterm scores received by 50 students in a chemistry class:

45 85 92 99 37 68 67 78 81 25
97 100 82 49 54 78 89 71 94 87
21 77 81 83 98 97 74 81 39 77
99 85 85 64 92 83 100 74 68 72
65 84 89 72 61 49 56 97 92 82

Construct a frequency distribution, frequency histogram, relative frequency histogram, frequency polygon, and cumulative frequency graph (ogive) using 6 classes.

Example 2:

The heights (in inches) of 30 adult males are listed below.

70 72 71 70 69 73 69 68 70 71
67 71 70 74 69 68 71 71 71 72
69 71 68 67 73 74 70 71 69 68

Construct a frequency distribution, frequency histogram, relative frequency histogram, frequency polygon, and cumulative frequency graph (ogive) using 5 classes.

2.2 More Graphs and Displays

Example 1:

Weights of Carry-On Luggage in Pounds

(for a random sample of 40 passengers returning from a vacation to Hawaii)

30 27 12 42 35 47 38 36 27 35
22 29 17 3 21 0 38 32 41 33
26 45 18 43 18 32 31 32 19 21
33 31 28 29 51 12 14 21 18 26

Example 2:

The following table represents a recent survey of 500 people that answered the following question: "How long do you spend on home telephone after 5 pm?"

Time	Number
Less than 1/2 hr.	296
1/2 hr to 1 hr	83
more than 1 hr	121

Example 3:

What will most likely cause you to be late to your early morning class?

Cause	Frequency
snoozing after alarm goes off	20
car trouble	3
too long over breakfast	15
last minute studying	18
finding the right clothes	12
other	4

Example 4: The following table gives mean daily caloric intake (all residents) and infant mortality rate (per 1,000 births) for nine countries:

Country	Mean daily calories	Infant mortality rate
Afganistan	1523	154
Austria	3495	6
Colombia	2678	24
Ehtiopia	1610	107
Germany	3443	6
Liberia	1640	153
New Zealand	3362	7
Turkey	3429	44
U.S.	3671	7

Example 5: You have been in the walking/jogging exercise program for 20 weeks, and for each week you have recorded the distance you covered in 30 minutes.

Week	1	2	3	4	5	6	7	8	9	10
Distance	1.5	1.4	1.7	1.6	1.9	2.0	1.8	2.0	1.9	2.0
Week	11	12	13	14	15	16	17	18	19	20
Distance	2.1	2.1	2.3	2.3	2.2	2.4	2.5	2.6	2.4	2.7

2.3 Measures of Central Tendency

Example 1:

The top 14 speeds, in mph, for Pro-Stock drag racing over the past two decades are:

181.1 202.2 190.1 201.4 191.3 201.4 192.2
201.2 193.2 201.2 194.5 199.2 196.0 196.2

Example 2:

The scores of the top ten finishers in a recent golf tournament:

71 67 67 72 76 72 73 68 72 72

Example 3:

The ages of 21 cars randomly selected in a student parking lot:

12 6 4 9 11 1 7 8 9 8 9 13 5 15 7 6 8 8 2 1 5

Example 4:

You are taking a class in which your grade is determined from:

Quizzes: 15% total

Exams (3): 15% each

Homework: 10%

Final: 30%

Your scores are: average quiz mean = 85, exams = 78, 81, 92, homework mean = 85 and your final = 89.

a) If the minimum average for B+ is 87, did you get B+ at the end of the semester?

b) What if the quiz mean was not given, but the quiz scores are given as 10, 12, 8, 2, 9, 7 (out of 12 points each), and only best 4 quizzes count towards your grade?

Example 5:

The average starting salary for 50 employees at a company is given:

10 with high-school diploma: \$27,000 each

25 with BA/BS degree: \$ 35,000 each

10 with MA/MS degree: \$47,000 each

5 with Ph.D. degree: \$59,500 each

How would you find the mean salary for these employees?

Would you add the 4 \$ amounts and divide by 4? Explain.

Example 6:

Approximate the mean of the grouped data:

Heights of Males	Frequency
63-65	3
66-68	6
69-71	7
72-74	4
75-77	3

2.4 Measures of Variation

Example 1:

Sample annual salaries (in thousand dollars) for public elementary school teachers are listed:

26.0 19.9 17.8 31.4 38.6 28.7 25.0

Example 2:

The heights (in inches) of ALL 10 adult males in an office are:

70 72 71 70 69 73 69 68 70 71

Example 3:

Midterm scores for 20 random students (in a class of 100):

82 45 37 98 100 74 87 89 63 76
75 61 43 99 86 86 75 92 65 80

What is the meaning of s (sample standard deviation)?

Example 4:

The mean value of land and buildings per acre from a sample of farms is \$2,400, with a standard deviation of \$450. Which of the following prices (\$/acre) would be considered unusual?

3325 2450 3200 1490 1675 2950

Example 5:

A random sample of the age of employees in a City Hall:

Age	frequency
20-29	5
30-39	10
40-49	12
50-59	8
60-69	5

What percentage of the City Hall employees are between 31.8 and 68.4 years old?

If there are 120 employees in a City Hall, approximately how many of them are:

- a) between 31.8 and 56.2 years old?
- b) older than 68.4?

Example 6:

How long will it take you to graduate from college? (These are responses from a sample of students on campus.)

Years	f
3	10
4	48
5	25
6	10
7	6
8	1

Assuming the bell-shaped distribution (normal distribution):

What percentage of students will need:

- a) more than 7.9 years to graduate?
- b) between 3.5 and 5.7 years to graduate?
- c) more than 1.3 years to graduate?

Example 7:

The mean time in a women's 400-m dash is 57.07 s, with a standard deviation of 1.05 s. Apply Chebychev's Theorem to the data using $k=3$. Explain the meaning of the values that you find. If there is a sample of 350 women, about how many would have time between 54.97 s and 59.17 s?

Example 8:

In a random sample, 10 students were asked to compute the distance they travel one way to school to the nearest tenth of a mile. The data is listed:

1.1 5.2 3.6 5.0 4.8 1.8 2.2 5.2 1.5 0.8

Using Chebychev's Theorem, approximate the percentage of students travel between 0 and 6.76 miles (one way) to school.

If there are 25,000 students on campus, approximate the number of students who travel between 0 and 6.76 miles (one way) to school.

Example 9:

SAT verbal scores are normally distributed with a mean of 489 and a standard deviation of 93. Use the Empirical Rule (also called 68-95-99.7 Rule) to determine what percentage of the scores lie:

- a) between 303 and 582.
- b) above 675?

If 3,500 students took the SAT verbal test, about how many received between 396 and 675 points?

Example 10:

The batting averages of Sammy Sosa and Barry Bonds for 13 recent years:

Sosa: $\bar{x} = 0.279$, $s = 0.033$

Bonds: $\bar{x} = 0.312$, $s = 0.027$

Which player is more consistent? Why?

Example 11:

Which data set has the highest a) mean , b) standard deviation

i) 0 | 9
1 | 5 8
2 | 3 3 7 7
3 | 2 5
4 | 1

ii) 0 |
1 | 5 8 9
2 | 3 3 7 3
3 | 2 5 6
4 |

iii) 10 | 9
11 | 5 8
12 | 3 3 7 7
13 | 2 5
14 | 1

Example 12:

Data entries: a b c d Mean of a, b, c, d is \bar{x} , and the standard deviation is s.

What will happen to the mean and standard deviation if we add 5 to each data entry?

What will happen to the mean and standard deviation if each data entry is 3 times larger.

2.5 Measures of Position

Example 1:

The ACT math scores of 15 high-school seniors:

18 15 25 24 21 17 32 30 20 27 28 24 18 27 28

Example 2:

In a random sample, 18 students were asked how far away (in miles) from campus do they live .

4.2 3.7 15.4 12.7 0.5 0 4.3 1.6 13.8
14.0 11.3 8.2 4.0 12.9 20.5 18 7.5 2.1

Example 3:

The heights (in inches) of 20 women are listed below.

70 71 65 60 62 68 67 68 70 73
60 61 61 65 64 68 69 69 63 65

a) Find the score that corresponds to 65th percentile.

b) What percentile corresponds to the score of 70?

c) What is the score that corresponds to 27th percentile?

Example 4:

10		4	9	3			
11		5	9	8	3		
12		3	9	7	7	6	
13		2	6	5			
14		0	6	3			

- a) Find the score that corresponds to 44th percentile?
- b) What percentile corresponds to the score of 135?
- c) What is the score that corresponds to 11th percentile?

Example 5:

John is taking biology and math. On the biology exam the mean is 82 with a standard deviation of 6, and on the math exam the mean is 78 with a standard deviation of 3. John received 85 on the biology exam, 80 on the math exam.

Use z-scores to determine on which test he performed better. What would you say if John scored 92 on the math exam? What if John received 79 on the biology exam and 76 on the math exam?

3.1 Basic Concepts of Probability and Counting

1. You have a red and black six-sided dice.
 - a) Develop the sample space that results from rolling these two dice.
 - b) Find all possible outcomes of getting at least 5 with the black dice.
 - c) Is “getting the sum of 4” a simple event?
2. How many pairs of letters from the English alphabet (with replacement) are possible? (Disregard the difference between uppercase and lower case letters.)
How will your answer change if replacements are not allowed? What if we make a difference between the uppercase and lowercase letters (without replacement)?
3. The phone numbers in U.S. consists of 10 digits (3 digits area code + 7 digits local number). How many different telephone numbers are possible within each area code, assuming that the local number cannot begin with 0 or 1?
4. Restaurant menu has: 5 appetizers, 10 main dishes, 4 desserts, 5 drinks. If you would like to order all 4, how many different meals can you order?
5. Utah license plate contains 6 characters: 1 letter followed by 3 numbers, followed by 2 letters (letters and numbers can repeat). How many different license plates can the state of Utah issue? What happens if letters and numbers cannot be repeated?
6. 2 coins (a dime and a nickel) are tossed. Find the probability that a) both coins land heads up, b) you get 1 head and 1 tail ?
7. A card is drawn from a standard deck of playing cards. Find the probability:
 - a) the card drawn is an ace,
 - b) the card drawn is a diamond,
 - c) the card drawn is a diamond, a heart, or a club.
8. Two 6-sided dice (black and white) are tossed. What is the probability that the sum of the two dice is 8?
9. The surgeon tells you that for every 150 surgeries that he/she performs, 6 patients need to come back for the second surgery. If you are the next patient, find the probability that you would need to have the second surgery.
10. How long does it take you to get ready for work/school:

Response	frequency
0-20 min	25
20-40 min	75
40-60 min	37
more than 1hr	15

What is the probability that the next person that answers to the survey says that it takes him/her a) 40-60 min. to get ready? b) 20-40 min. or 40-60 min. to get ready?

11. 2 dice are tossed. Find the probability that their sum is not seven.

12. Assume that the probability of having a boy or a girl is 0.5. In a family of 5 children, what is the probability that:

- a) all children are boys,
- b) all the children are the same gender,
- c) there is at least 1 girl.

13. A probability experiment consists of tossing a coin and rolling a die.

Draw a tree diagram.

Find the following probabilities:

- a) tossing a tail and rolling an even number,
- b) tossing a head or tail and rolling a number greater than 3,
- c) tossing a head or rolling a number greater than 3.

Find the complement of this event (in c).

14. The probability that a manufactured part for the computer is working is 0.992. What is the probability that the part is not working?

15. The heights (in inches) of all males enrolled in history class:

6		5 5 6 6 6 8 9 9 9 9
7		0 0 1 2 2 2 3 4 4 5 5 6 6 7

If a male student is selected at random, find the probability that his height is:

- a) at least 69 in.
- b) between 70 in. and 73 in. (inclusive)
- c) more than 75 in.
- d) not 69 in.

3.2 Conditional Probability and the Multiplication Rule

1. Two cards are selected in sequence from a standard deck (52 cards). Find the probability that the second card is an ace, given that the first card is:

- a) a seven (assume that it is not replaced),
- b) an ace (assume that it is not replaced),

What would be the answer in a) and b) if the first card is replaced?

2. Study of the effect of coffee on gall stones:

	Gall stone disease	No disease
No coffee	385	14,068
Coffee	91	4,806

Find the probability that a patient:

- a) has a gall stone disease, given that he/she did not consume coffee,
- b) does not have a gall stone disease, given that he/she does consume coffee.

3. You are spinning the spinner with numbers 1 through 6. Assume that the spinner cannot stop on a line. You are spinning twice. Find the probability that:

- a) the first spin stops on an odd number and the second spin stops on a multiple of 3,
- b) the first spin shows a number less than 4 and the sum of 2 spins is equal to 5.

4. The probability that a student will pass organic chemistry class is 0.85.

3 students are randomly selected. Find the probability that:

- a) all 3 will pass the class,
- b) none of 3 students will pass the class,
- c) at least 1 student will pass.

5. Three people are selected at random. Find the probability:

- a) all 3 are born on Tuesday
- b) all 3 are born on the same day of the week
- c) all 3 are born on a different day of the week

6. A 3 person jury must be selected at random (without replacement) from a pool of 12 people that has 7 men and 5 women. Find the probability of selecting an a) all-female jury, b) all-male jury.

7. You purchase 20 lottery tickets for which the probability of winning some prize on a single ticket is 1 in 10. What is the probability that you have at least 1 winning ticket among the 20 tickets?

8. Find the probability of drawing 3 diamonds in a row from a regular deck of cards

- a) the drawn card is returned to the deck each time

- b) the drawn card is not returned to the deck each time

9. Refer to problem #8. Find the probabilities if you are drawing 3 fives in a row.

10. Of campus professors 60% are male, and of these, 15% work for College of Humanities. Find the following probabilities:

- randomly selected professor is a male and works for College of Humanities.
- randomly selected professor is a male and does not work for College of Humanities.
- randomly selected professor is a female and works for College of Humanities.

11. Student ages Frequency

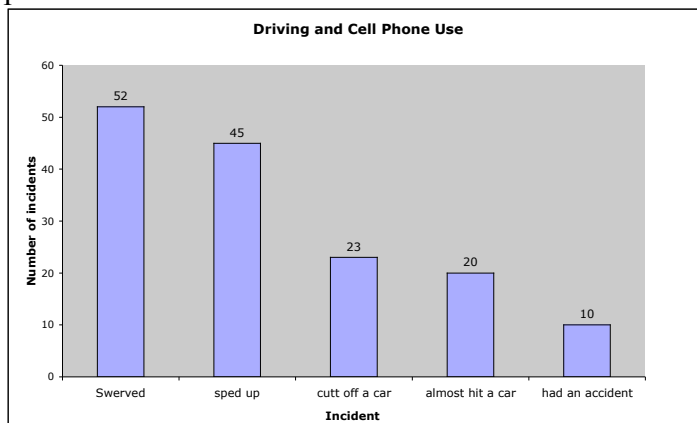
17 – 26	149
27 – 36	85
37 – 46	46
47 – 56	15
57 and over	5

- Find the probability that a student chosen at random is between 27 and 36 years old.
- If 4 students are randomly selected (without replacement), find the probability that all four students are between 37 and 46 years old.
- If four students are randomly selected (without replacement), what is the probability that at least 1 will be 57 years or older?
- If four students are randomly selected (without replacement), what is the probability that none of these four students are between 17 and 26 years old?

12. The probability that a person in the U.S. has type A+ blood is 32.5%. Five unrelated people in the U.S. are selected at random. Find the probability that:

- all five have type A+.
- none of the five has type A+.
- at least one of the five has type A+.

13. The following graph shows the types if incidents encountered with drivers using cell phones.



- a) Find the probability that a randomly chosen incident involves cutting off a car.
- b) Find the probability that two randomly chosen incidents (without replacement) both had an accident.
- c) Find the probability that a randomly chosen incident did not involve cutting off a car.
- d) Find the probability that from randomly selected 3 incidents (without replacement) at least one involved speeding up.

14. The access code for a garage door consists of 5 digits. The first digit cannot be 0. Find the probability that you guess the code from the first try?

15. Refer to the problem #15 from 3.1 and assume that there are no replacements. Find the probability that 2 randomly chosen male students are both between 69 in. and 73 in. tall.

Find the probability that at least 1 of 2 students is between 69 in. and 73 in. tall.

16. If you roll a 6 sided die 8 times, find the probability that you roll an odd number at least once.

3.3 The Addition Rule

1. Find the probability of rolling either a 2 or a 5 when you roll a single die.
2. Find the probability of drawing either a queen or a spade from a standard deck of cards.
3. You select one person at random from a room with 15 people: 5 blond men, 2 dark hair men, 4 blond women and 4 dark hair women. What is the probability that you will select either a women or a blond person?
4. If you roll a die, find the probability that you roll a number greater than 4 or an odd number?
5. A card is selected at random from a standard deck of cards. Find each probability:
 - a) Randomly selected card is a black suit or a king.
 - b) Randomly selected card is a four or a face card.
 - c) Randomly selected card is a 7 or a king.

6.

	Psychology major	Non-Psychology major
Males	150	9,750
Females	375	11,300

A student is selected at random. Find the following probabilities:

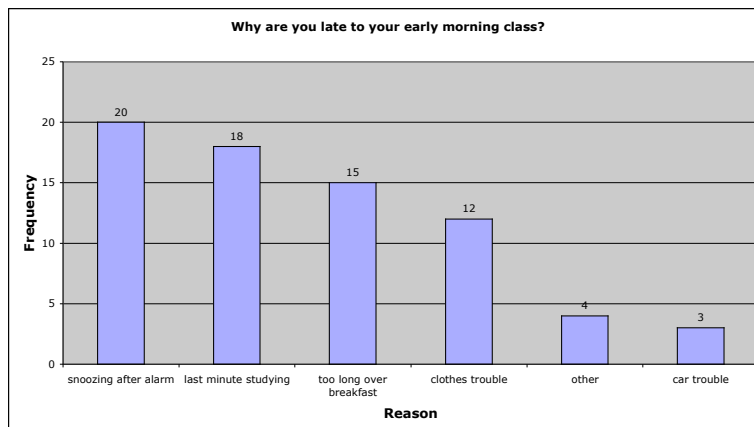
- a) the student is a female or a psychology major
- b) the student is a male or not psychology major
- c) the student is a male and psychology major
- d) Given that the student is a female, what is the probability that she is a psychology major?
- e) If we select 3 students at random (without replacement), what is the probability that all 3 students are women and majoring in psychology?

7. Sam is playing a game with 2 dice (black and red) and on his next move he needs to throw a sum bigger than 9 in order to win. What is the probability that Sam will win?

8. If you roll a die, find the probability that you roll a number less than 5 or an even number.

9. If we have 3 sets A, B and C, find $P(A \text{ or } B \text{ or } C)$.

10. From Section 2.2. we had this Pareto chart:



If you randomly selected a person from a sample, find each probability:

- a) The person is late because of last minute studying or clothes trouble.
 - b) The person is not late because of last minute studying.
- c) If you randomly selected 4 people from the study (without replacement), what is the probability that all 4 were late because of car trouble?
- d) If you randomly selected 4 people from the study (without replacement), what is the probability that all 4 were late because of trouble with clothes?

3.4 Additional Topics in Probability and

1. In how many different ways can we arrange letters A, B, C, D ?

2. We have 4 objects, A, B, C, and D, and we want to make ordered arrangements of 2 objects. How many would we have?

3. How many distinguishable permutations can you make out of letters that make the word MATHEMATICS?

4. Suppose you coach a team of 12 swimmers and you need to put together a 4-person relay team. In how many different ways can you do this?

5. Calculate:

$$\begin{array}{lll}
 15! = & {}_{25}P_3 = & \frac{{}_{10}C_3}{{}_{40}C_3} \\
 12! = & {}_{40}C_3 = & \frac{15!}{12!} = \\
 {}_{10}C_3 = & \frac{{}_{40}P_3}{{}_{35}P_7} = & \frac{18!}{13!} =
 \end{array}$$

6. The scholarship committee is considering 25 applicants for 3 awards (1st award - \$3,500, 2nd award - \$3,000, 3rd award - \$2,000).

How many different ways are possible to award these scholarships?

7. There are 30 passengers that still need to check-in and get a boarding pass. The airline representative will upgrade 5 passengers to the first class, seats 1B, 1D, 3A, 3C, 4B. In how many different ways can the airline representative do this?

8. 20 runners enter the competition. In how many ways can they finish 1st, 2nd, and 3rd?

9. How many ways can 3 Republicans, 2 Democrats, and 1 Independent be chosen from 10 Republicans, 8 Democrats, and 5 Independents to fill 6 positions on City Council?

10. A security code consists of 2 letters followed by 3 digits. The first letter can not be A, B, or C, and the last digit can not be a 0. What is the probability of guessing the security code in one trial? 2 trials?

11. A shipment of 40 fancy calculators contains 5 defective units. In how many ways can a college bookstore buy 20 of these units and receive:

a) no defective units

b) one defective unit

c) at least 17 good units

d) What is the probability of the bookstore receiving 2 defective units?

e) Find the probability of receiving at most 2 bad calculators?

12. You are dealt a hand of four cards from a standard deck. Find the probability that:

a) the first three cards are of the same suit and one is of a different suit.

4.1 Probability Distributions

1. Doctor's office collected the results of 350 patients who answered the following question: "Rate your pain from 1 to 10, where 1-almost no pain, 10-extreme pain". These were the results:

Rating, x	Frequency
1	22
2	27
3	35
4	36
5	40
6	56
7	70
8	31
9	13
10	20

Find the mean.

2. Construct a probability distribution:

number of cars, x	households	$P(x)$
0	100	
1	325	
2	450	
3	94	
4	31	

Find the probability of randomly selecting a household that has at least two cars.

Find the mean (expected value).

3. 1,500 students were asked: "How many parking tickets did you receive within the last 5 years?"

number of parking tickets x	$P(x)$
0	0.150
1	0.280
2	0.267
3	0.167
4	0.100
5	0.036

Find the mean and standard deviation.

4. Local charity is selling \$5 raffle tickets as part of Christmas fund-raising program. 1,200 tickets are sold. The four prizes are \$1,000, \$800, \$500, and \$350. You buy one ticket. What is $E(x)$, expected value of your gain/loss?

5. The total number of defects per batch of DVDs inspected is given:

Defects	0	1	2	3	4	5
Batches	95	113	87	64	13	8

Construct a probability distribution and find the mean and standard deviation.

4.2 Binomial Distributions

1. Decide whether the experiment is a binomial experiment. If it is, specify the values of n , p , q , and x . If it is not, explain why.

- a) A bag contains 4 white marbles, 7 red marbles, and 5 black marbles. You randomly select 3 marbles from the bag, without replacement. The random variable represents the number of black marbles.
- b) A certain medical procedure has 85% chance of success on patients. The surgery is performed on 8 patients. The random variable represents the number of successful surgeries.
- c) You take an exam that consists of 10 multiple-choice questions. Each question has 5 possible answers, only one of which is correct. You will randomly guess the answer to each question. The random variable represents the number of correct answers.

2. Refer to 1b). Create a binomial probability distribution. Then, find the probability of the surgery being successful on a) exactly 6 patients, b) at least 5 patients.

3. Refer to 1c).

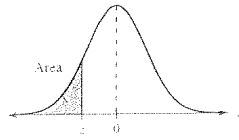
a) Create a binomial probability distribution.

b) To get a B, you need to answer at least 8 questions correctly. Find the probability that you will get a B.

c) Find the probability that you answer at most 6 questions correctly.

- d) Find the probability that you answer between 3 and 6 questions correctly.
 - e) Find the mean and standard deviation for the number of questions that you answer correctly.
4. 6.5% of people in the U.S. have A- blood type. You randomly select 6 Americans and ask them if their blood type is A-.
- a) Find the probability that all 6 are type A-.
 - b) Find the probability that at most 4 of them are type A-.
 - c) Find the mean and standard deviation.

Table 4—Standard Normal Distribution



z	.09	.08	.07	.06	.05	.04	.03	.02	.01	.00
-3.4	.0002	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003
-3.3	.0003	.0004	.0004	.0004	.0004	.0004	.0004	.0005	.0005	.0005
-3.2	.0005	.0005	.0005	.0006	.0006	.0006	.0006	.0006	.0007	.0007
-3.1	.0007	.0007	.0008	.0008	.0008	.0008	.0009	.0009	.0009	.0010
-3.0	.0010	.0010	.0011	.0011	.0011	.0012	.0012	.0013	.0013	.0013
-2.9	.0014	.0014	.0015	.0015	.0016	.0016	.0017	.0018	.0018	.0019
-2.8	.0019	.0020	.0021	.0021	.0022	.0023	.0023	.0024	.0025	.0026
-2.7	.0026	.0027	.0028	.0029	.0030	.0031	.0032	.0033	.0034	.0035
-2.6	.0036	.0037	.0038	.0039	.0040	.0041	.0043	.0044	.0045	.0047
-2.5	.0048	.0049	.0051	.0052	.0054	.0055	.0057	.0059	.0060	.0062
-2.4	.0064	.0066	.0068	.0069	.0071	.0073	.0075	.0078	.0080	.0082
-2.3	.0084	.0087	.0089	.0091	.0094	.0096	.0099	.0102	.0104	.0107
-2.2	.0110	.0113	.0116	.0119	.0122	.0125	.0129	.0132	.0136	.0139
-2.1	.0143	.0146	.0150	.0154	.0158	.0162	.0166	.0170	.0174	.0179
-2.0	.0183	.0188	.0192	.0197	.0202	.0207	.0212	.0217	.0222	.0228
-1.9	.0233	.0239	.0244	.0250	.0256	.0262	.0268	.0274	.0281	.0287
-1.8	.0294	.0301	.0307	.0314	.0322	.0329	.0336	.0344	.0351	.0359
-1.7	.0367	.0375	.0384	.0392	.0401	.0409	.0418	.0427	.0436	.0446
-1.6	.0455	.0465	.0475	.0485	.0495	.0505	.0516	.0526	.0537	.0548
-1.5	.0559	.0571	.0582	.0594	.0606	.0618	.0630	.0643	.0655	.0668
-1.4	.0681	.0694	.0708	.0721	.0735	.0749	.0764	.0778	.0793	.0808
-1.3	.0823	.0838	.0853	.0869	.0885	.0901	.0918	.0934	.0951	.0968
-1.2	.0985	.1003	.1020	.1038	.1056	.1075	.1093	.1112	.1131	.1151
-1.1	.1170	.1190	.1210	.1230	.1251	.1271	.1292	.1314	.1335	.1357
-1.0	.1379	.1401	.1423	.1446	.1469	.1492	.1515	.1539	.1562	.1587
-0.9	.1611	.1635	.1660	.1685	.1711	.1736	.1762	.1788	.1814	.1841
-0.8	.1867	.1894	.1922	.1949	.1977	.2005	.2033	.2061	.2090	.2119
-0.7	.2148	.2177	.2206	.2236	.2266	.2296	.2327	.2358	.2389	.2420
-0.6	.2451	.2483	.2514	.2546	.2578	.2611	.2643	.2676	.2709	.2743
-0.5	.2776	.2810	.2843	.2877	.2912	.2946	.2981	.3015	.3050	.3085
-0.4	.3121	.3156	.3192	.3228	.3264	.3300	.3336	.3372	.3409	.3446
-0.3	.3483	.3520	.3557	.3594	.3632	.3669	.3707	.3745	.3783	.3821
-0.2	.3859	.3897	.3936	.3974	.4013	.4052	.4090	.4129	.4168	.4207
-0.1	.4247	.4286	.4325	.4364	.4404	.4443	.4483	.4522	.4562	.4602
-0.0	.4641	.4681	.4721	.4761	.4801	.4840	.4880	.4920	.4960	.5000

Critical Values

Level of Confidence c	z_c
0.80	1.28
0.90	1.645
0.95	1.96
0.99	2.575

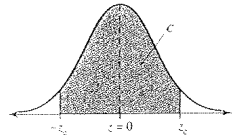


Table A-3, pp. 681–682 from *Probability and Statistics for Engineers and Scientists*, 6e by Walpole, Meyers, and Myers. Copyright 1997. Reprinted by permission of Pearson Prentice Hall, Upper Saddle River, N.J.

A normal distribution curve is shown with a vertical dashed line at the mean and a solid vertical line at a point x to the right of the mean. The area under the curve to the left of x is shaded with diagonal lines and labeled "Area".

[illegible]

5.1 Introduction to Normal Distributions and the Standard Normal Distribution

1. Find the cumulative area that corresponds to a z-score of: a) 1.25 b) -2.31.
2. Find the area under the standard normal curve to the right of:
a) $z = 1.36$ b) $z = -2.67$ c) $z = 3.15$
3. Find the area under the standard normal curve between:
a) $z = -2.55$ and $z = 1.08$ b) $z = -1.0$ and $z = 1.37$
c) $z = -2.4$ and $z = -0.47$ d) $z = 0.78$ and $z = 2.68$
4. Find: a) $P(z < -0.51 \text{ or } z > 2.6)$
b) $P(z < 1.4 \text{ or } z > 3.04)$
c) $P(-1.26 < z < 3.25)$
d) $P(0 < z < 2.89)$

5.2 Normal Distributions: Finding Probabilities

1. The weights of adult male beagles are normally distributed, with a mean of 25 pounds and a standard deviation of 3 pounds. A beagle is randomly selected. Find the probability that:
a) the beagle's weight is less than 24 pounds.
b) the beagle's weight is between 23 and 26 pounds.
c) the beagle's weight is more than 29 pounds.
2. The test scores for the exam in statistics class have a mean of 78 points and standard deviation of 9 points. A student is randomly selected. Find the probability that the score is:
a) more than 95.
b) less than 30.
c) between 80 and 90.

If there are 70 students in that class, about how many will receive between 90 and 95 points?

3. Toyota Camry: Breaking distance on a wet surface is normally distributed with a mean of 149 ft. and a standard deviation of 5.28 ft.

Find the probability that the randomly picked Toyota Camry will have a breaking distance

- a) between 140 and 149 feet,
- b) more than 160 feet,
- c) less than 145 feet.

4. Assume that the mean annual consumption of chocolate is normally distributed with a mean of 5.2 pounds per person and a standard deviation of 1.9 pounds per person.

- a) What percent of people annually consume less than 2.7 pounds per year? Would it be unusual for a person to consume about 2.7 pounds of chocolate per year?
- b) In a group of 150 people, about how many consume
 - i) between 4.5 and 6.7 pounds of chocolate per year?
 - ii) more than 6 pounds?

5.3 Normal Distributions: Finding Values

1. Find the z-score that corresponds to a cumulative area of 0.4761.

2. Find the z-score that has 12.71% of the distribution's area to its right.

3. Find the z-score for which 75% of the distribution's area lies between $-z$ and z .

4. Find the z-score that corresponds to each percentile:

- a) P_8
- b) P_{95}
- c) P_{87}

5. The monthly phone bills in a city are normally distributed with a mean of 30\$ and a standard deviation of 12\$. Find the x-values that correspond to z-scores of -2.35 , 3.17 , and 0.23 . Explain the meaning of your answers.

6. Annual U.S. per capita orange use: $\mu = 11.4 \text{ lb}$, $\sigma = 3 \text{ lb}$

- a) What annual per capita use of oranges represents the 10th percentile?
- b) What annual per capita use of oranges represents the third quartile (75th percentile)?
- c) If 275 people are randomly selected, about how many would use more than 15 pounds of oranges annually?
- d) Find the minimum value that would be included in the top 15% of orange use.
- e) Find the value that corresponds to the first quartile.

7. The weight of bags of pretzels are normally distributed with a mean of 150 gr. and a standard deviation of 5 gr. Bags in the upper 4.5% are too heavy and must be repackaged. Also, the bags in the lower 5% do not meet the minimum weight requirement and must

be repackaged. What is the range of weight for a pretzel bag that does not need to be repackaged?

If you randomly select 125 bags (before the weight is checked), about how many would need to be repackaged?

8. In a survey of men in the United States (ages 20-29), the mean height was 69.6 inches with a standard deviation of 3.0 inches.

a) What height represents the 47th percentile?

b) What height represents the first quartile?

c) If 320 men are randomly selected, about how many of them are taller than 71 inches?

9.2 Linear Regression

1. Age and Hours Slept: The age (in years) and the number of hours slept in a day by 10 infants are given:

Age	0.1	0.2	0.4	0.7	0.6	0.9	0.1	0.2	0.4	0.9
Hours	14.9	14.5	13.9	14.1	13.9	13.7	14.3	13.9	14.0	14.1

a) Find the equation of the regression line.

b) Construct a scatter plot of the data and draw the regression line.

2. Age and Systolic blood pressure:

Age, x	Systolic blood pressure, y
16	109
25	122
39	143
45	132
49	199

Do you notice any unusual data values?

a) Find the equation of the regression line.

b) Construct a scatter plot of the data and draw the regression line.

c) Use the regression equation to predict the systolic blood pressure for someone who is i) 30, ii) 70, iii) 47, iv) 5 years old.

d) Use the regression equation to predict the age of someone who has a systolic blood pressure of i) 120, ii) 160.

WORKSHEET – Math 1040

1. A study found that the mean migration distance of the green turtle was 2200 kilometers and the standard deviation was 625 kilometers. Assume that the distances are normally distributed.

- a) Find the probability that a randomly selected green turtle migrated a distance between 1900 and 2400 kilometers?
- b) If you randomly select 400 green turtles and measure the migration distance for these turtles, about how many of them migrate a distance more than 2960 kilometers?

2. The probability that a person in the U.S. has O+ blood type is 38%.

- a) Find the probability that a randomly chosen person in the U.S. does not have type O+.
- b) If four unrelated people in the U.S. are selected at random, find the probability that all four have O+.
- c) If seven unrelated people in the U.S. are selected at random, find the following probabilities:
 - i) least one has O+ blood type.
 - ii) at most 2 have O+ blood type.
 - iii) exactly 6 have O+ blood type.

3. Five people are selected at random. Find the probability that all five are born on a different day of the week.

4. Data set: Amount (in \$) spent on books for a semester:

107 472 279 249 520 376 188 341 266 199
242 173 101 189 286 486 239 340 281 290

Construct a frequency distribution table for the data set using 5 classes.

Class	Frequency	Midpoint	Relative frequency	Cumulative Frequency
-------	-----------	----------	--------------------	----------------------

Construct a relative frequency histogram and a cumulative frequency graph (ogive).

5. Eight people need to be selected for a jury from a group of twelve men and ten women.

- i) In how many different ways can you select a jury of four men and four women?
- ii) Find the probability of selecting a jury of five men and three women.
- iii) Find the probability of selecting a jury with at least six men.

6. One in four adults say he/she has no trouble sleeping at night. You randomly select five adults and ask if he/she has no trouble sleeping at night.

- a) Find the probability that the number of people (from this group of five randomly selected adults) who say that they have no trouble sleeping is at least 4.
- b) Find the mean and standard deviation.

7. Find: $P(z < 0.15 \text{ or } z > 2.30)$

WORKSHEET - Solutions

1) a) $P(1900 < x < 2400) = P(-0.48 < z < 0.32) =$

$= 0.6255 - 0.3156 = \boxed{0.3099}$

b) $P(x > 2960) = P(z > 1.22) = 1 - 0.8888 = 0.1112$

$400 \times 0.1112 = 44.48 \approx \boxed{44}$

2) a) $1 - 0.38 = 0.62$

b) $(0.38)^4 = 0.02085$

c) i) $1 - (0.62)^4 = 0.96478$

ii) $P(0) + P(1) + P(2) =$

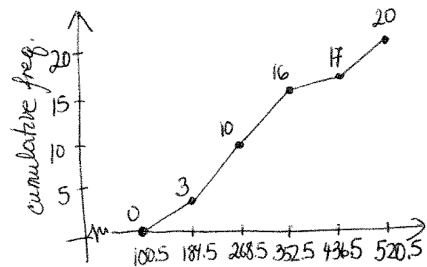
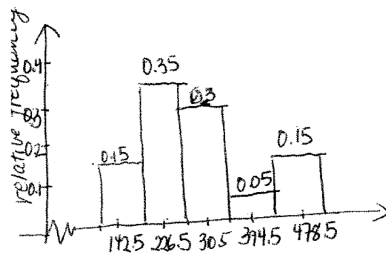
$= {}_7C_0 (0.38)^0 (0.62)^7 + {}_7C_1 (0.38)^1 (0.62)^6 +$
 $+ {}_7C_2 (0.38)^2 (0.62)^5 = 0.46411$

iii) $P(6) = {}_7C_6 (0.38)^6 (0.62)^1 = 0.01307$

3) $\frac{7}{7} \cdot \frac{6}{7} \cdot \frac{5}{7} \cdot \frac{4}{7} \cdot \frac{3}{7} = 0.1499$

4) min = 101 class width =
 max = 520 $\frac{520 - 101}{5} = 83.8 \rightarrow 84$

class	f	Midpoint	relative f	Cumulative f
01-184	3	142.5	$3/20 = 0.15$	3
185-268	7	226.5	$7/20 = 0.35$	10
269-352	6	310.5	0.3	16
353-436	1	394.5	0.05	17
437-520	3	478.5	0.15	20
	<u>20</u>			



MUST use class boundaries

5) a) ${}_{12}C_4 \cdot {}_{10}C_4 = 103,950$

b) $\frac{{}_{12}C_5 \cdot {}_{10}C_3}{{}_{22}C_8} = 0.29721$

c) $\frac{{}_{12}C_6 \cdot {}_{10}C_2 + {}_{12}C_7 \cdot {}_{10}C_1 + {}_{12}C_8 \cdot {}_{10}C_0}{{}_{22}C_8} = 0.15635$

6) a) $P(4) + P(5) =$

$= {}_5C_4 (0.25)^4 (0.75)^1 + {}_5C_5 (0.25)^5 (0.75)^0 =$
 $= 0.015625$

b) $\bar{x} = np = 5 \cdot 0.25 = 1.25 \approx 1.3$
 $s = \sqrt{npq} = \sqrt{5 \cdot 0.25 \cdot 0.75} =$
 $= 0.9682 \approx 1.0$

7) $P(z < 0.15 \text{ or } z > 2.3) =$
 $= 0.5596 + (1 - 0.9893) =$
 $= 0.5703$