Stats for Business  HOMEWORK 2 (3 problems from Topic 1, 11 problems from Topic 2)

DIRECTIONS:

- See How To Succeed With Stats Homework on page 2 of the syllabus. Students report that using a similar accounting system helps them get the most out of the homework and solid quiz and exam preparation.

- Refer to Topic 1 and Topic 2 Notes and Examples for guidance.

- Write answers out on separate paper and collect/organize in your own binder. It’s a good idea to check answers to each problem before going on to the next one.

---

Topic 1 Problems

Problem 1 (Truth in advertising)
Wal-Mart, Inc. advertises that almost all of the products it sells are manufactured in the United States, and Made In The U.S.A. signs can be found throughout every Wal-Mart store in the U.S. Recently, a consumer watchdog group named Consumers for Truth in Advertising accused Wal-Mart of false advertising. The consumer group claims that, in fact, more than half of all Wal-Mart stores in the U.S. generate at least 20% of sales revenue from foreign-made goods. Wal-Mart denies the claim, asserting instead that no more than 10% of its U.S. stores generate at least 20% of sales revenue from foreign-made goods.

Suppose that there are 6400 Wal-Mart stores in the U.S., and that an independent auditing company randomly selects 40 of these. The auditing company carefully audits each of these 40 stores and records for each a “Yes” or “No” answer to whether or not the store generates at least 20% of sales revenue from foreign-made goods. Suppose that the auditor finds that 13 out of the 40 stores audited generate at least 20% of sales revenue from foreign-made goods.

(a) Apply the Six Steps of Inference. (But before Step 1 also express the question non-numerically.)

(b) Does Wal-Mart appear to be correct in its claims? Does the consumer group appear to be correct in its claims? Explain, based on the auditor’s results.

(continued)
Problem 2 (Gas versus diesel)
The American Automobile Association (AAA) is a national organization which also has 50 state chapters. Members of the Iowa chapter of the AAA would like to compare prices of regular gasoline to prices of diesel fuel within the state of Iowa.

In particular, suppose that the Iowa chapter would like to test the theory that diesel is more expensive on average than regular gasoline at Iowa service stations which sell both fuels, on Sept. 30, 2011. The AAA national organization has provided the Iowa chapter with a database of prices, shown in the table below. The database was developed as follows:

- Five zip codes were randomly selected from all zip codes in the state of Minnesota, and five zip codes were randomly selected from all zip codes in the state of Iowa.

- In each selected zip code, a service station which sells both fuels was randomly chosen from all such service stations in that zip code. The prices for both diesel and regular gas on Sept. 30, 2011 at the chosen station were recorded in the database.

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>City</th>
<th>State</th>
<th>Price (dollars/gallon) for Regular Gas</th>
<th>Price (dollars/gallon) for Diesel Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>50005</td>
<td>Minerva</td>
<td>Iowa</td>
<td>3.66</td>
<td>3.73</td>
</tr>
<tr>
<td>50021</td>
<td>Ankeny</td>
<td>Iowa</td>
<td>3.63</td>
<td>3.60</td>
</tr>
<tr>
<td>55005</td>
<td>Bethel</td>
<td>Minnesota</td>
<td>3.81</td>
<td>3.88</td>
</tr>
<tr>
<td>56258</td>
<td>Marshall</td>
<td>Minnesota</td>
<td>3.86</td>
<td>3.92</td>
</tr>
<tr>
<td>50101</td>
<td>Galt</td>
<td>Iowa</td>
<td>3.72</td>
<td>3.80</td>
</tr>
<tr>
<td>56678</td>
<td>Becida</td>
<td>Minnesota</td>
<td>3.83</td>
<td>3.88</td>
</tr>
<tr>
<td>55732</td>
<td>Pike</td>
<td>Minnesota</td>
<td>3.93</td>
<td>3.98</td>
</tr>
<tr>
<td>50438</td>
<td>Miller</td>
<td>Iowa</td>
<td>3.60</td>
<td>3.67</td>
</tr>
<tr>
<td>52050</td>
<td>Greeley</td>
<td>Iowa</td>
<td>3.58</td>
<td>3.64</td>
</tr>
<tr>
<td>55383</td>
<td>Norwood</td>
<td>Minnesota</td>
<td>3.84</td>
<td>3.87</td>
</tr>
</tbody>
</table>

(a) Complete Step 2 of the Six Steps: Identify the statistical population or populations.
   (Choose the single best answer from the five choices (A1)–(A5) below.)

(A1) All service stations in Iowa which serve both diesel and regular gas
(A2) All automobile users in the state of Iowa
(A3) There are two populations:
   - Pop 1 = All service stations in Iowa which serve both diesel and regular gas
   - Pop 2 = All service stations in Minnesota which serve both diesel and regular gas
(A4) There are two populations:
   - Pop 1 = All automobile users in the state of Iowa
   - Pop 2 = All automobile users in the state of Minnesota
(A5) There are two populations:
   - Pop 1 = All zip codes in the state of Iowa
   - Pop 2 = All zip codes in the state of Minnesota

(continued)
(b) Complete Step 3: Identify the sample or samples.
(Choose the single best answer.)

(A1) Five service stations in Iowa whose prices for diesel and regular gas are recorded in the database

(A2) Five automobile users in the state of Iowa who purchased fuel on Sept. 30, 2011

(A3) There are two samples:
- Sample 1 = Five service stations in Iowa whose prices for diesel and regular gas are recorded in the database
- Sample 2 = Five service stations in Minnesota whose prices for diesel and regular gas are recorded in the database

(A4) There are two samples:
- Sample 1 = Five automobile users in the state of Iowa who purchased fuel on Sept. 30, 2011
- Sample 2 = Five automobile users in the state of Minnesota who purchased fuel on Sept. 30, 2011

(A5) There are two samples:
- Sample 1 = Five zip codes in the state of Iowa from which a single service station is chosen
- Sample 2 = Five zip codes in the state of Minnesota from which a single service station is chosen

(A6) There are two samples:
- Sample 1 = Five service stations in Iowa whose price for diesel only is recorded in the database.
- Sample 2 = Five service stations in Iowa whose price for regular gas only is recorded in the database.

(c) Complete Step 4: Identify the variable or variables measured on the sample or samples.
(Write out the answer.)

(d) Does the theory appear to be correct? (Choose the single best answer.)

(A1) Yes, since 3.797 > 3.746
(A2) No, since 3.797 > 3.746
(A3) Yes, since 3.688 > 3.638
(A4) No, since 3.688 > 3.638

(continued)
Problem 3  (Gas versus diesel, revisited)
The American Automobile Association (AAA) is a national organization which also has 50 state chapters. Members of the Iowa chapter of the AAA would like to compare prices of regular gasoline to prices of diesel fuel within the state of Iowa.

In particular, suppose that the Iowa chapter would like to test the theory that diesel is more expensive on average than regular gasoline at Iowa service stations which sell both fuels, on Sept. 30, 2011.

The AAA national organization has provided the Iowa chapter with a database of prices, shown in the table below. The database was developed as follows:

- Ten zip codes were randomly selected from all zip codes in the state of Minnesota, and ten zip codes were randomly selected from all zip codes in the state of Iowa.

- In each selected zip code, a service station which sells both fuels was randomly chosen from all such service stations in that zip code. The price for either diesel or regular gas (but not both) on Sept. 30, 2011 at the chosen station was recorded in the database.

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>City</th>
<th>State</th>
<th>Price (dollars/gallon) for Regular Gas</th>
<th>Price (dollars/gallon) for Diesel Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>50005</td>
<td>Minerva</td>
<td>Iowa</td>
<td>3.66</td>
<td>—</td>
</tr>
<tr>
<td>50021</td>
<td>Ankeny</td>
<td>Iowa</td>
<td>3.63</td>
<td>—</td>
</tr>
<tr>
<td>50066</td>
<td>Dawson</td>
<td>Iowa</td>
<td>3.58</td>
<td>—</td>
</tr>
<tr>
<td>51591</td>
<td>Red Oak</td>
<td>Iowa</td>
<td>3.60</td>
<td>—</td>
</tr>
<tr>
<td>52146</td>
<td>Egan</td>
<td>Iowa</td>
<td>3.72</td>
<td>—</td>
</tr>
<tr>
<td>50101</td>
<td>Galt</td>
<td>Iowa</td>
<td>—</td>
<td>3.80</td>
</tr>
<tr>
<td>51249</td>
<td>Cloverdale</td>
<td>Iowa</td>
<td>—</td>
<td>3.73</td>
</tr>
<tr>
<td>50613</td>
<td>Cedar Falls</td>
<td>Iowa</td>
<td>—</td>
<td>3.60</td>
</tr>
<tr>
<td>50438</td>
<td>Miller</td>
<td>Iowa</td>
<td>—</td>
<td>3.67</td>
</tr>
<tr>
<td>52050</td>
<td>Greeley</td>
<td>Iowa</td>
<td>—</td>
<td>3.64</td>
</tr>
<tr>
<td>55373</td>
<td>Rockford</td>
<td>Minnesota</td>
<td>3.81</td>
<td>—</td>
</tr>
<tr>
<td>55380</td>
<td>Silver Creek</td>
<td>Minnesota</td>
<td>3.84</td>
<td>—</td>
</tr>
<tr>
<td>56006</td>
<td>Mankato</td>
<td>Minnesota</td>
<td>3.86</td>
<td>—</td>
</tr>
<tr>
<td>56280</td>
<td>Porter</td>
<td>Minnesota</td>
<td>3.83</td>
<td>—</td>
</tr>
<tr>
<td>55072</td>
<td>Danforth</td>
<td>Minnesota</td>
<td>3.93</td>
<td>—</td>
</tr>
<tr>
<td>55005</td>
<td>Bethel</td>
<td>Minnesota</td>
<td>—</td>
<td>3.88</td>
</tr>
<tr>
<td>56258</td>
<td>Marshall</td>
<td>Minnesota</td>
<td>—</td>
<td>3.92</td>
</tr>
<tr>
<td>56678</td>
<td>Becida</td>
<td>Minnesota</td>
<td>—</td>
<td>3.88</td>
</tr>
<tr>
<td>55732</td>
<td>Pike</td>
<td>Minnesota</td>
<td>—</td>
<td>3.98</td>
</tr>
<tr>
<td>55383</td>
<td>Norwood</td>
<td>Minnesota</td>
<td>—</td>
<td>3.87</td>
</tr>
</tbody>
</table>

(questions for Problem 3 on next page)
(a) Complete Step 2. (Choose the single best answer.)

(A1) All service stations in Iowa which serve both diesel and regular gas

(A2) All automobile users in the state of Iowa

(A3) There are two populations:
    - Pop 1 = All service stations in Iowa which serve both diesel and regular gas
    - Pop 2 = All service stations in Minnesota which serve both diesel and regular gas

(A4) There are two populations:
    - Pop 1 = All automobile users in the state of Iowa
    - Pop 2 = All automobile users in the state of Minnesota

(A5) There are two populations:
    - Pop 1 = All zip codes in the state of Iowa
    - Pop 2 = All zip codes in the state of Minnesota

(b) Complete Step 3. (Choose the single best answer.)

(A1) Ten automobile users in the state of Iowa who purchased fuel on Sept. 30, 2011

(A2) There are two samples:
    - Sample 1 = Ten service stations in Iowa whose prices for diesel and regular gas are recorded in the database
    - Sample 2 = Ten service stations in Minnesota whose prices for diesel and regular gas are recorded in the database

(A3) There are two samples:
    - Sample 1 = Ten automobile users in the state of Iowa who purchased fuel on Sept. 30, 2011
    - Sample 2 = Ten automobile users in the state of Minnesota who purchased fuel on Sept. 30, 2011

(A4) There are two samples:
    - Sample 1 = Ten zip codes in the state of Iowa from which a single service station is chosen
    - Sample 2 = Ten zip codes in the state of Minnesota from which a single service station is chosen

(A5) There are two samples:
    - Sample 1 = Five service stations in Iowa whose price for diesel only is recorded in the database.
    - Sample 2 = Five service stations in Iowa whose price for regular gas only is recorded in the database.

(c) Write out the answer to Step 5.

(d) Write out the answer to Step 6.
Topic 2 Problems

1. Often an easy way to remember a Stats idea or concept (such as standard deviation) is to keep a simple example in mind. We’ll try this by comparing variability three ways in a really simple example!

Compare the lengths of brown squirrels to black squirrels in southeastern Texas. Suppose three squirrels of each type were caught, with the following length measurements, in centimeters:

<table>
<thead>
<tr>
<th>Brown Squirrels</th>
<th>Black Squirrels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specimen</td>
<td>Length</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
</tr>
</tbody>
</table>

Grab the long-hand formula for sample variance $s^2$ from page 51 in the Notebook:

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$$

(a) Find $s_{Brown}^2$ and $s_{Brown}$ by filling in all blanks in the table below, similar to the table used for the sample of daily Hotspot use on Notebook page 51:

<table>
<thead>
<tr>
<th>Brown Squirrels</th>
</tr>
</thead>
<tbody>
<tr>
<td>$i$</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

$s_{Brown}^2 = \underline{}$  
$s_{Brown} = \underline{}$

(b) Now repeat for Find $s_{Black}^2$ and $s_{Black}$:

<table>
<thead>
<tr>
<th>Black Squirrels</th>
</tr>
</thead>
<tbody>
<tr>
<td>$i$</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

$s_{Black}^2 = \underline{}$  
$s_{Black} = \underline{}}$
(c) The simple graph below shows lengths of both samples of squirrels. Which type of squirrel appears to be more variable in length, based on the graph?

![Graph showing length of squirrels with values 14, 16, 18, 20, 22.]

(d) Consider variability a second way — *numerically* instead of *graphically*. Provide *numerical evidence* which supports your graphical conclusion in (c).

(e) Assume that biologists know that both brown squirrels and black squirrels are bell-shaped in their lengths. What are the *minimum* and *maximum* lengths between which approximately 95% of all brown squirrels will measure?

(f) What are the *minimum* and *maximum* lengths between which approximately 95% of all black squirrels will measure?

(g) Consider variability yet another (third) way — in bell curves. Which type of squirrel shows greater variability in length based on answers (e) and (f) alone? Be *specific* in your answer. (Cite numbers other than standard deviation or variance.)

2. Twenty students who took Business Stats last semester were interviewed for the number of midterm exams (out of two exams) for which the student was personally satisfied with his/her performance.

   1  2  1  0  2
   2  1  1  0  0
   2  2  1  1  0
   0  1  2  1  1

(a) Construct a histogram for these data.
(b) What proportion of students in the sample were satisfied with more than one exam?
(c) What proportion of students in the sample were satisfied with less than two exams?
(d) If a student is selected at random from the sample, what’s the probability that he or she was satisfied with two exams?

(continued)
3. The number of home loan applications granted during January, 2013 for a sample of 50 commercial banks follows:

2 4 2 32 9 9 2 6 3 1
14 9 16 7 8 19 6 4 4 2
4 18 0 6 13 7 2 8 0 1
14 1 2 2 18 8 24 1 8 5
1 3 11 18 26 3 12 23 5 4

(a) Construct a histogram for these data.
(b) What fraction of these 50 commercial banks granted 10 or fewer home loans in January, 2013?

4. Consider the following data:

652 648 658 662
653 654 670 671
674 666 679 679
653 652 667 671
655 677 646 678
682 678 669 650

(a) What’s the appropriate choice for the stem in a stem-and-leaf plot? What’s the choice for the leaf?
(b) Make the stem plot.

5. A group of school children in a physical education class was measured according to the number of consecutive skips without error while skipping rope.

24 9 13 98 17 41 23 22 29 25 20 22 21 18 15 62 22 13 41 18
13 16 75 11 32 9 16 9 16 6 54 16 6 20 10 37 9 4 8 22
21 31 1 16 19

(a) Construct a stem-and-leaf plot.
(b) Does the Bell Curve Rule provide a good description for the population of all such school children? Why or why not?
(c) What’s the best estimate of the minimum number of skips without error by the 40% of children who do the best??

6. Given \( n = 10 \) measurements: 3, 5, 4, 6, 10, 5, 6, 9, 2, 8, find \( \bar{x} \) and \( m \).

(continued)
7. Often consumers can save considerable cash by purchasing computers directly from the manufacturer—an average of $900 by some estimates. The direct-sale satisfaction ratings (on a scale of 1 to 9) for seven such companies, based on a survey of 4000 buyers, are shown below.

<table>
<thead>
<tr>
<th>Company</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sony</td>
<td>7.5</td>
</tr>
<tr>
<td>Dell</td>
<td>7.9</td>
</tr>
<tr>
<td>Lenovo</td>
<td>7.4</td>
</tr>
<tr>
<td>Gateway</td>
<td>8.2</td>
</tr>
<tr>
<td>Hewlett Packard</td>
<td>7.8</td>
</tr>
<tr>
<td>Zotac</td>
<td>7.7</td>
</tr>
<tr>
<td>Apple</td>
<td>8.0</td>
</tr>
</tbody>
</table>

(a) Find the average satisfaction rating for these seven companies.

(b) Find the typical satisfaction rating.

(c) If you were shopping for a computer, would you be interested in the average satisfaction rating? If not, what measure would you be interested in, and why?

8. Given \( n = 5 \) measurements: 2, 4, 0, 3, 1, find the sample mean \( \bar{x} \) and sample standard deviation \( s \). (Don’t use the long-hand formula for \( s^2 \). Input numbers into your calculator instead!) (Calculate \( s \) correct to 3 decimal places.)

9. Bob is a cashier at the New Pioneer Food Co-op in Coralville. Times (in seconds) for Bob to check customers out are recorded as 15, 62, 53, 11, 38, 75, 112, 40, 22, 57.

(a) Calculate \( \bar{x} \) and \( s \) (correct to 2 decimal places.)

(b) Apply the Bell Curve Rule to describe the relevant population.

(c) Explain why applying the Bell Curve Rule to Bob’s checkout times seems to have been a mistake.

10. The inflation rate is the percentage increase in general price levels from one year to the next. Inflation has long been a problem in a particular South American country. The data below show annual inflation rates for that country over the past 25 years. (Tip: What do negative numbers mean?)

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>6.0</td>
<td>7.5</td>
<td>15.0</td>
<td>12.0</td>
</tr>
<tr>
<td>6.5</td>
<td>8.0</td>
<td>4.0</td>
<td>5.5</td>
<td>6.0</td>
</tr>
<tr>
<td>5.0</td>
<td>12.0</td>
<td>-1.0</td>
<td>-3.5</td>
<td>3.0</td>
</tr>
<tr>
<td>7.5</td>
<td>5.0</td>
<td>10.0</td>
<td>8.0</td>
<td>3.5</td>
</tr>
<tr>
<td>9.0</td>
<td>12.0</td>
<td>6.5</td>
<td>1.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

(a) Calculate \( \bar{x} \) and \( s \).

(b) Apply the Bell Curve Rule to describe the relevant population.

11. Television commercials on the Fox Business Network average 75 seconds, with standard deviation 20 seconds. Assuming that times for commercials on FBN are bell-shaped,

(a) Approximately what percentage of commercials last less than 35 seconds?

(b) Approximately what percentage of commercials last longer than 55 seconds?

(end of assignment)