# Statistics 1040, Section 003, Quiz 1 (20 Points)

Friday, August 29, 2008

**Your Name:** _____

**Question 1:** Controlled Experiments/Observational Studies I (**14 Points**)

(*hypothetical*) Does regularly taking vitamin C help protect people against flu?

A _____ was conducted to answer this question. The _____ were 500 volunteering college students, assigned _____ to two groups of 250 students. The students in the _____ took regularly a tablet of vitamin C, whereas those in the _____ took an identically looking and tasting pill, called _____. Neither participating students nor personell administrating drugs to them knew who was taking which pill, in other words, it was a _____ experiment. After a couple of months, the numbers of flu cases in both groups were compared ...

Fill the gaps in the paragraph above using the most appropriate words from the following list:

**placebo**
**double–blind**
**haphazardly**
**treatment group**
**observational study**
**randomly**
**single–blind**
**vaccine**
**confounding factor**
**objects**
**control group**
**controlled experiment**
**subjects**
**polio**

**Please turn over!**

**Question 2:** Controlled Experiments/Observational Studies II (**6 Points**)

In 1990, four passengers were killed by crashes on commuter airlines, compared to 39 killed on scheduled carriers (like United, TWA, and so forth). **True** or **false**? Circle your answer and explain: the data show that if you have to fly, it is safer to do so on a commuter airline.

# Statistics 1040, Section 003, Quiz 2 (20 Points)

Friday, September 5, 2008

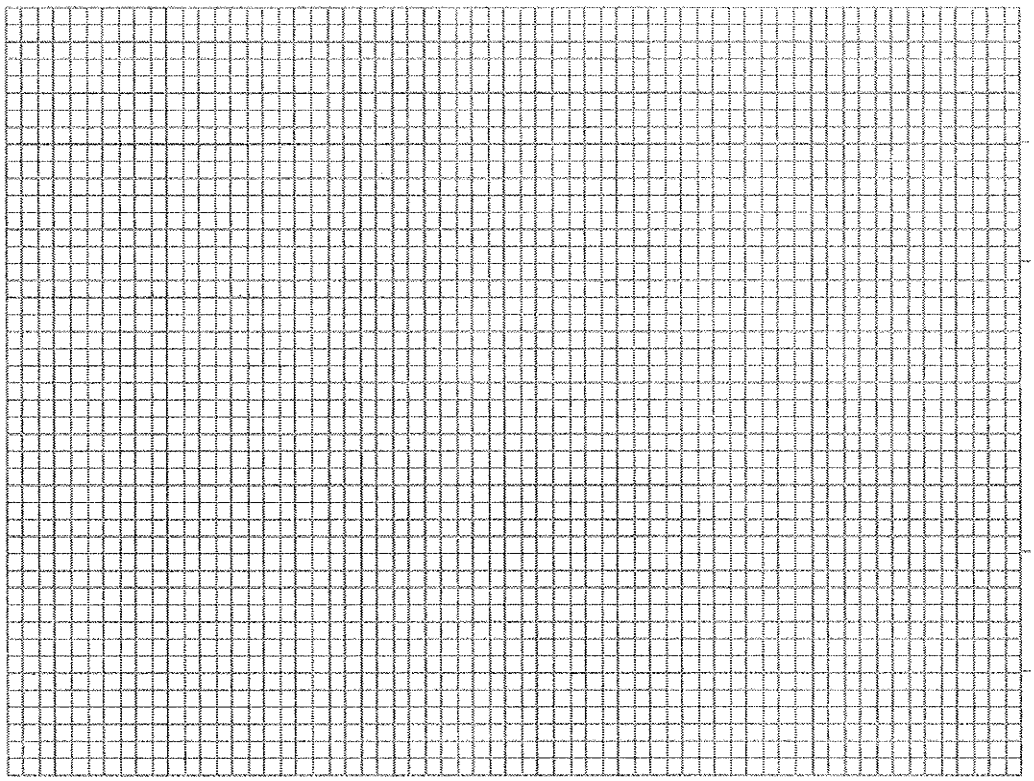
**Your Name:** _____

**Question 1:** Histograms **(14 Points)**

The following table is for the gestational age of 1210 babies:

| Gestational Age | Number |
|---|---|
| 230-250 | 47 |
| 250-270 | 206 |
| 270-290 | 731 |
| 290-310 | 199 |
| 310-330 | 27 |

Draw a histogram for these data on the graph paper provided. Make sure to label the axes.



**Please turn over!**

**Question 2:** Observational Studies / Controlled Experiments (**6 Points**)

For each of the following studies, determine whether the study in question was a **randomized controlled experiment** or an **observational study** (circle the correct answer).

- Twenty male employees and twenty female employees participate in research designed to compare "attitudes towards the Social Security System" of men and women. Each individual responds to a series of questions on a survey. Mean scores are computed for men and for women.

  randomized controlled experiment  observational study

- A researcher wants to learn whether regularly taking zinc supplements may reduce the risk of getting a cold. Volunteers in this study chose to (or chose not to) take a zinc supplement.

  randomized controlled experiment  observational study

- A researcher wants to learn about whether computer simulations help students better understand statistical concepts. She puts the names of 20 volunteers into a box and randomly draws the names of 10 people who will use computer simulations to learn statistical concepts. The other 10 study participants will use a conventional approach, without computer simulations, to learn the same concepts.

  randomized controlled experiment  observational study

# Statistics 1040, Section 003, Quiz 3 (20 Points)

Friday, September 12, 2008

**Your Name:** _____

**Question 1:** Measures of Center and Spread **(20 Points)**

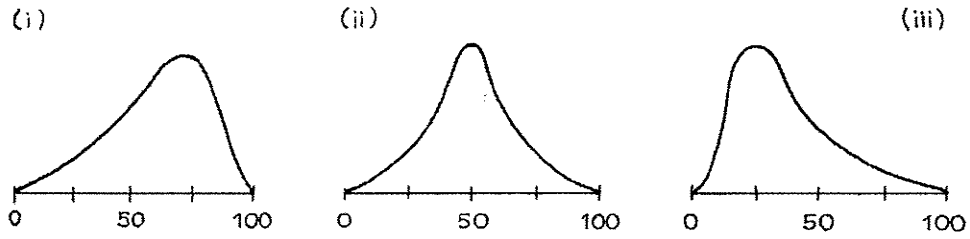
1. **(10 Points)** Find the average and the standard deviation of the following two lists of numbers:

| Numbers | Average | Standard deviation |
|---|---|---|
| 17, 17, 17, 17, 17 | _____ | _____ |
| 15, 16, 17, 18, 19 | _____ | _____ |

Show your work! Use formulas provided on the back where necessary.

**Please turn over!**

2. **(10 Points)** Below are sketches of histograms for three lists.




(a) In a scrambled order, the averages are 40, 50, 60. Match the histograms with averages:

Histogram (i): average =

Histogram (ii): average =

Histogram (iii): average =

(b) Match the histograms with the description (circle your answer):

- The median is less than the average. Histogram (i), (ii), or (iii).
- The median is about equal to the average. Histogram (i), (ii), or (iii).
- The median is bigger than the average. Histogram (i), (ii), or (iii).

(c) The SD for histogram (i) is a lot smaller than that for histogram (iii). **True** or **false**? Circle your answer and explain:

**Formulas:**

$$\text{avg} = \frac{\text{sum of all numbers}}{\text{how many numbers}}$$

$$\text{SD} = \sqrt{\text{average of } [(\text{deviations from avg})^2]}$$

# Statistics 1040, Section 003, Quiz 4 (20 Points)

Friday, September 19, 2008

**Your Name:** _____

**Question 1:** Normal Approximation for Data **(20 Points)**

The Graduate Record Examination (GRE) is a test taken by college students who intend to pursue a graduate degree in the United States. For around 112,000 male US citizens who took the General GRE Test in 2005–06, the mean for the quantitative ability portion of the exam was about 600 and the standard deviation was about 140 (`http://www.ets.org/Media/Tests/GRE/pdf/05-06_factors_final.%20pdf.pdf`). We can assume that the histogram follows a normal curve. **Show your work!**

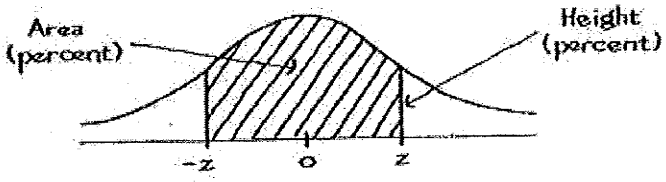
- **(7 Points)** The percentage of male US citizens who scored **more than 670** on the GRE test is roughly _____ %.

- **(7 Points)** The percentage of male US citizens who scored **between 348 and 572** is about _____ %.

- **(6 Points)** In order to be among the top 10% of all male US citizens, a student must have obtained a minimum GRE score of about _____.

**Please turn over!**

# Tables




## A NORMAL TABLE

| *z* | *Area* | *z* | *Area* | *z* | *Area* |
|---|---|---|---|---|---|
| 0.00 | 0 | 1.50 | 86.64 | 3.00 | 99.730 |
| 0.05 | 3.99 | 1.55 | 87.89 | 3.05 | 99.771 |
| 0.10 | 7.97 | 1.60 | 89.04 | 3.10 | 99.806 |
| 0.15 | 11.92 | 1.65 | 90.11 | 3.15 | 99.837 |
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| 0.25 | 19.74 | 1.75 | 91.99 | 3.25 | 99.885 |
| 0.30 | 23.58 | 1.80 | 92.81 | 3.30 | 99.903 |
| 0.35 | 27.37 | 1.85 | 93.57 | 3.35 | 99.919 |
| 0.40 | 31.08 | 1.90 | 94.26 | 3.40 | 99.933 |
| 0.45 | 34.73 | 1.95 | 94.88 | 3.45 | 99.944 |
| 0.50 | 38.29 | 2.00 | 95.45 | 3.50 | 99.953 |
| 0.55 | 41.77 | 2.05 | 95.96 | 3.55 | 99.961 |
| 0.60 | 45.15 | 2.10 | 96.43 | 3.60 | 99.968 |
| 0.65 | 48.43 | 2.15 | 96.84 | 3.65 | 99.974 |
| 0.70 | 51.61 | 2.20 | 97.22 | 3.70 | 99.978 |
| 0.75 | 54.67 | 2.25 | 97.56 | 3.75 | 99.982 |
| 0.80 | 57.63 | 2.30 | 97.86 | 3.80 | 99.986 |
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| 0.90 | 63.19 | 2.40 | 98.36 | 3.90 | 99.990 |
| 0.95 | 65.79 | 2.45 | 98.57 | 3.95 | 99.992 |
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| 1.20 | 76.99 | 2.70 | 99.31 | 4.20 | 99.9973 |
| 1.25 | 78.87 | 2.75 | 99.40 | 4.25 | 99.9979 |
| 1.30 | 80.64 | 2.80 | 99.49 | 4.30 | 99.9983 |
| 1.35 | 82.30 | 2.85 | 99.56 | 4.35 | 99.9986 |
| 1.40 | 83.85 | 2.90 | 99.63 | 4.40 | 99.9989 |
| 1.45 | 85.29 | 2.95 | 99.68 | 4.45 | 99.9991 |

# Statistics 1040, Section 003, Quiz 5 (20 Points)

Friday, September 26, 2008

**Your Name:** _____

**Question 1:** Measurement Error **(6 Points)**

You send a yardstick to a local laboratory for calibration, asking that the procedure be repeated three times. They report the following values:

35.96 inches  36.01 inches  36.03 inches

If you send the yardstick back for a fourth calibration, you would expect to get 36 inches, give or take

(a) .01 inches or so  (b) .03 inches or so  (c) .06 inches or so

**Circle your answer and do the necessary calculations.**

**Question 2:** Correlation **(8 Points)**

Investigators are studying registered students at the University of California. The students fill out questionnaires giving their year of birth, age (in years), age of mother, and so forth. Fill in the blanks, using the options given below:

1. The correlation coefficient between student's age and year of birth is _____.
2. The correlation coefficient between student's age and mother's age is _____.

(a) -1  (b) nearly -1  (c) somewhat negative
(d) 0  (e) somewhat positive  (f) nearly 1  (g) 1  (h) -2.0  (i) 2.0
(j) can't tell without the data

**Please turn over!**

**Question 3:** Change Of Scale (**6 Points**)

True or false? **Circle your answer!**

1. If you add 7 to each entry on a list, that adds 7 to the average.
   **True / False**

2. If you add 7 to each entry on a list, that adds 7 to the SD.
   **True / False**

3. If you double each entry on a list, that doubles the average.
   **True / False**

4. If you double each entry on a list, that doubles the SD.
   **True / False**

5. If you change the sign of each entry on a list, that changes the sign of the average.
   **True / False**

6. If you change the sign of each entry on a list, that changes the sign of the SD.
   **True / False**

**Formulas:**

$$\text{avg} = \frac{\text{sum of all numbers}}{\text{how many numbers}}$$

$$\text{SD} = \sqrt{\text{average of } [(\text{deviations from avg})^2]}$$

# Statistics 1040, Section 003, Quiz 6 (20 Points)

Friday, October 10, 2008

**Your Name:** _____

**Question 1:** Regression I **(17 Points)**

For women age 25–34 in the HANES5 sample, the relationship between height and income can be summarized as follows:

| | | |
|---|---|---|
| height: | average = 64.0 inches | SD = 2.5 inches |
| income: | average = $21,000 | SD = $20,000 |
| | r = 0.20 | |

Fill the blanks in the statements below and **show all the work needed to obtain the answers.**

1. (5 Points) Find the regression equation for predicting income from height.

   The equation is: _____

2. (3 Points) Using your regression equation from (1.), what is the regression estimate for the predicted income for a woman who is 60 inches tall?

   The answer is: $_____

**Please turn over!**

3. (3 Points) Find the r.m.s. error for your answer in the previous part.

   The answer is: $\$$_____

4. (3 Points) Can we use the regression equation from (1.) to predict the income for a woman who is 80 inches tall? **Yes / No.** Circle your answer. If **yes**, then calculate the predicted income. If **no**, then explain why not.

5. (3 Points) The regression equation indicates: The taller a woman, the higher her income on average. Indicate a major confounding factor and explain which effect this factor has.

**Please turn over!**

**Question 2:** Regression II **(3 Points)**

In a large study (hypothetical) of the relationship between parental income and the IQs of their children, the following results were obtained:

| | | |
|---|---|---|
| income: | average = \$90,000 | SD = \$45,000 |
| IQ: | average = 100 | SD = 15 |
| | r = 0.50 | |

For each income group (\$0–\$9999, \$10,000–\$19,999, \$20,000–\$29,999, etc.), the average IQ of children with parental income in that group was calculated and then plotted above the midpoint of the group (\$5,000, \$15,000, \$25,000, etc.). It was found that the points on this graph followed a straight line very closely. The slope of this line (in IQ points per dollar) would be about:

6,0000 3,000 1,500 500 1/500 1/1,500 1/3,000 1/6,000

**Circle your answer!**

Formulas:

$$\text{r.m.s. error} = \sqrt{1 - r^2} \times \text{SD}_y$$

$$\text{slope} = r \times \frac{\text{SD}_y}{\text{SD}_x} \qquad \text{intercept} = \text{avg}_y - \text{slope} \times \text{avg}_x$$

# Statistics 1040, Section 003, Quiz 7 (20 Points)

Wednesday, October 15, 2008

**Your Name:** _____

**Question 1:** Chance/Probability **(20 Points)**

A drawer of socks contains 22 socks of which 8 are black, 10 are green, and 4 are blue. In the dark, a child chooses two socks at random to wear to school. **Show your work!**

1. **(5 Points)** What is the chance that the first sock is blue?

   The chance is: _____ %

2. **(5 Points)** What is the chance that both socks are blue?

   The chance is: _____ %

3. **(5 Points)** What is the chance that one sock is blue and the other sock is green?

   The chance is: _____ %

4. **(5 Points)** What is the chance that both socks are the same color?

   The chance is: _____ %

# Statistics 1040, Section 003, Quiz 8 (20 Points)

Friday, October 24, 2008

**Your Name:** _____

**Question 1:** Box Models, EV, SE, and Normal Curve (**16 Points**)

You are participating in a new game that consists of tossing a 10–sided die, with sides numbered from 1 to 10. The die is fair, i.e., it has the same chance of landing on any side. Every time the die shows a number that is a multiple of 3 (i.e., 3, 6, or 9) you win \$4, otherwise you lose \$1, except when the die lands on 10, in which case you win (or lose) nothing (\$0). Assume you are tossing this die 200 times. **Show your work!**

1. (**3 Points**) Find the box model.

2. (**4 Points**) Find the expected value of your gain/loss.

3. (**4 Points**) Find the standard error of your gain/loss.

4. (**5 Points**) Assuming that many players participate in this game, find the percentage of players who win \$100 or more (after 200 tosses each).

**Please turn over!**

**Question 2:** Law of Averages (**4 Points**)

**Circle your answer** for each of the following four parts. You don't have to provide any explanations.

1. (**1 Point**) A die will be rolled some number of times, and you win \$1 if it shows an ace ( ⚀ ) more than 20% of the time.

   Which is better: **60 rolls** or **600 rolls**?

2. (**1 Point**) As in 1.), but you win the dollar if the percentage of aces is more than 15%.

   Which is better: **60 rolls** or **600 rolls**?

3. (**1 Point**) As in 1.), but you win the dollar if the percentage of aces is between 15% and 20%.

   Which is better: **60 rolls** or **600 rolls**?

4. (**1 Point**) As in 1.), but you win the dollar if the percentage of aces is exactly $16\frac{2}{3}\%$.

   Which is better: **60 rolls** or **600 rolls**?

**Formulas:**

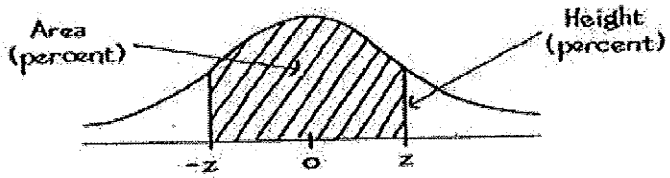
$$\text{box average} = \frac{\text{sum of all numbers in box}}{\text{how many numbers in box}}$$

$$\text{box SD} = \sqrt{\text{average of [(deviations from box average)}^2]}$$

$$\text{EV}_{sum} = \text{number of draws} \times \text{box average}$$

$$\text{SE}_{sum} = \sqrt{\text{number of draws}} \times \text{box SD}$$

# Tables

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| 1.40 | 83.85 | 2.90 | 99.63 | 4.40 | 99.9989 |
| 1.45 | 85.29 | 2.95 | 99.68 | 4.45 | 99.9991 |

# Statistics 1040, Section 003, Quiz 9 (20 Points)

Friday, October 31, 2008

**Your Name:** _____

**Question 1:** Probability Histograms I (**14 Points**)

Four hundred draws will be made at random with replacement from the box $\boxed{1}\ \boxed{3}\ \boxed{5}\ \boxed{7}$.
**Show your work!**

1. Estimate the chance that the sum of the draws will be more than 1,500.
   The chance is: _____ %

2. Estimate the chance that there will be fewer than 90 $\boxed{3}$'s.
   The chance is: _____ %

**Please turn over!**

**Question 2:** Probability Histograms II **(4 Points)**

One hundred draws are made at random with replacement from a box with ninety–nine tickets marked "0" and one ticket marked "1". **Circle the correct answer.**

1. The sum will be around 1, give or take 1 or so.
   **True / False**

2. There is about a 68% chance that the sum will be in the range 0 to 2.
   **True / False**

**Question 3:** Sampling **(2 Points)**

(Hypothetical) A survey is carried out by the finance department to determine the distribution of household size in a certain city. They draw a simple random sample of 1,000 households. After several visits, the interviewers find people at home in only 653 of the sample households. Rather than face such a high non–response rate, the department draws a second batch of households, and uses the first 347 completed interviews in the second batch to bring the sample up to its planned strength of 1,000 households. The department counts 3,087 people in these 1,000 households, and estimates the average household size in the city to be about 3.1 persons.

Is this estimate likely to be **too low**, **too high**, or **about right**?

**Circle your answer!**

**Please turn over!**

**Formulas:**

$$\text{box average} = \frac{\text{sum of all numbers in box}}{\text{how many numbers in box}}$$

$$\text{box SD} = \sqrt{\text{average of } [(\text{deviations from box average})^2]}$$

$$\text{EV}_{sum} = \text{number of draws} \times \text{box average}$$

$$\text{SE}_{sum} = \sqrt{\text{number of draws}} \times \text{box SD}$$

Shortcut formulas for a box that contains only *two* different numbers:

$$\text{average} = \frac{(\text{smaller} \times \text{how many}) + (\text{bigger} \times \text{how many})}{\text{how many tickets in the box}}$$

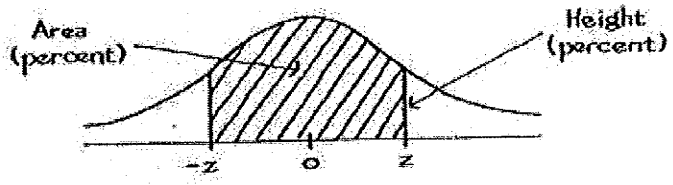
$$\text{SD} = (\text{bigger - smaller}) \times \sqrt{\frac{\text{fraction}}{\text{bigger}} \times \frac{\text{fraction}}{\text{smaller}}}$$

Shortcut formulas for a box that contains only $\boxed{0}$'s and $\boxed{1}$'s:

$$\text{average} = \frac{\text{number of } \boxed{1}\text{'s}}{\text{how many tickets in the box}}$$

$$\text{SD} = \sqrt{\frac{\text{fraction}}{\text{of } \boxed{1}\text{'s}} \times \frac{\text{fraction}}{\text{of } \boxed{0}\text{'s}}}$$

# Tables

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| 1.40 | 83.85 | 2.90 | 99.63 | 4.40 | 99.9989 |
| 1.45 | 85.29 | 2.95 | 99.68 | 4.45 | 99.9991 |

# Statistics 1040, Section 003, Quiz 10 (20 Points)

Friday, November 14, 2008

**Your Name:** _____

**Question 1:** The Accuracy of Percentages (**20 Points**)

The National Assessment of Educational Progress administers standardized achievement tests to nationwide samples of 17–year–olds in school. One year, the tests covered history and literature. You may assume that a simple random sample of size 6,000 was taken. Only 36.1% of the students in the sample knew that Chaucer wrote *The Canterbury Tales*, but 95.2% knew that Edison invented the light bulb.

1. (**10 Points**) Is it possible to find a 95% confidence interval for the percentage of all 17–year–olds in school who knew that Chaucer wrote *The Canterbury Tales*?
   **Yes** or **No**? – Circle your answer.
   If yes, calculate this CI (and show your work). If no, clearly indicate why this is not possible.

2. (**10 Points**) Is it possible to find a 95% confidence interval for the percentage of all 17–year–olds in school who knew that Edison invented the light bulb?
   **Yes** or **No**? – Circle your answer.
   If yes, calculate this CI (and show your work). If no, clearly indicate why this is not possible.

**Please turn over!**

**Formulas:**

$$\text{box average} = \frac{\text{sum of all numbers in box}}{\text{how many numbers in box}}$$

$$\text{box SD} = \sqrt{\text{average of } [(\text{deviations from box average})^2]}$$

$$\text{EV}_{sum} = \text{number of draws} \times \text{box average}$$

$$\text{SE}_{sum} = \sqrt{\text{number of draws}} \times \text{box SD}$$

$$\text{EV}_{avg} = \text{box average} \qquad \text{SE}_{avg} = \frac{\text{SE}_{sum}}{\text{number of draws}}$$

Shortcut formulas for a box that contains only *two* different numbers:

$$\text{average} = \frac{(\text{smaller} \times \text{how many}) + (\text{bigger} \times \text{how many})}{\text{how many tickets in the box}}$$

$$\text{SD} = (\text{bigger - smaller}) \times \sqrt{\frac{\text{fraction}}{\text{bigger}} \times \frac{\text{fraction}}{\text{smaller}}}$$

Shortcut formulas for a box that contains only $\boxed{0}$ 's and $\boxed{1}$ 's:

$$\text{average} = \frac{\text{number of } \boxed{1} \text{ 's}}{\text{how many tickets in the box}}$$

$$\text{SD} = \sqrt{\frac{\text{fraction}}{\text{of } \boxed{1} \text{ 's}} \times \frac{\text{fraction}}{\text{of } \boxed{0} \text{ 's}}}$$

$$\text{EV}_{\%} = \%\text{ of } \boxed{1} \text{ 's in the box}$$

$$\text{SE}_{\%} = \frac{\text{SEsum}}{\text{number of draws}} \times 100\%$$

# Statistics 1040, Section 003, Quiz 11 (20 Points)

Wednesday, November 19, 2008

**Your Name:** _____

**Question 1:** The Accuracy of Averages **(20 Points)**

One year, there were about 3,000 institutions of higher learning in the U.S. (including junior colleges and community colleges). As part of a continuing study of higher education, the Carnegie Commission took a simple random sample of 400 of these institutions. The average enrollment in the 400 sample schools was 3,700, and the SD was 6,500. The Commission estimates the average enrollment at all 3,000 institutions to be around 3,700; they put a give–or–take number of 325 on this estimate.

Say whether each of the following statements is true or false, and explain. If you need more information to decide, say what you need and why.

1. **(4 Points)** An approximate 68%–confidence interval for the average enrollment of all 3,000 institutions runs from 3,375 to 4,025.

   **Yes**, **No**, or **Need more information**.
   Circle your answer and explain.

2. **(4 Points)** If a statistician takes a simple random sample of 400 institutions out of 3,000, and goes one SE either way from the average enrollment of the 400 sample schools, there is about a 68% chance that this interval will cover the average enrollment of all 3,000 schools.

   **Yes**, **No**, or **Need more information**.
   Circle your answer and explain.

**Please turn over!**

3. **(4 Points)** About 68% of the schools in the sample had enrollments in the range $3{,}700 \pm 6{,}500$.

   **Yes**, **No**, or **Need more information**.
   Circle your answer and explain.

4. **(4 Points)** It is estimated that 68% of the 3,000 institutions of higher learning in the U.S. enrolled between $3{,}700 - 325 = 3{,}375$ and $3{,}700 + 325 = 4{,}025$ students.

   **Yes**, **No**, or **Need more information**.
   Circle your answer and explain.

5. **(4 Points)** The normal curve can't be used to figure confidence levels here at all, because the data don't follow the normal curve.

   **Yes**, **No**, or **Need more information**.
   Circle your answer and explain.

**Formulas:**

$$\text{box average} = \frac{\text{sum of all numbers in box}}{\text{how many numbers in box}}$$

$$\text{box SD} = \sqrt{\text{average of } [(\text{deviations from box average})^2]}$$

$$\text{EV}_{sum} = \text{number of draws} \times \text{box average}$$

$$\text{SE}_{sum} = \sqrt{\text{number of draws}} \times \text{box SD}$$

$$\text{EV}_{avg} = \text{box average} \qquad \text{SE}_{avg} = \frac{\text{SE}_{sum}}{\text{number of draws}}$$

Shortcut formulas for a box that contains only *two* different numbers:

$$\text{average} = \frac{(\text{smaller} \times \text{how many}) + (\text{bigger} \times \text{how many})}{\text{how many tickets in the box}}$$

$$\text{SD} = (\text{bigger} - \text{smaller}) \times \sqrt{\frac{\text{fraction}}{\text{bigger}} \times \frac{\text{fraction}}{\text{smaller}}}$$

Shortcut formulas for a box that contains only $\boxed{0}$'s and $\boxed{1}$'s:

$$\text{average} = \frac{\text{number of } \boxed{1}\text{'s}}{\text{how many tickets in the box}}$$

$$\text{SD} = \sqrt{\frac{\text{fraction}}{\text{of } \boxed{1}\text{'s}} \times \frac{\text{fraction}}{\text{of } \boxed{0}\text{'s}}}$$

$$\text{EV}_{\%} = \%\text{ of } \boxed{1}\text{'s in the box}$$

$$\text{SE}_{\%} = \frac{\text{SEsum}}{\text{number of draws}} \times 100\%$$

# Statistics 1040, Section 003, Quiz 12 (20 Points)

Monday, November 24, 2008

**Your Name:** _____

**Question 1:** Tests of Significance **(20 Points)**

Many companies are experimenting with "flex–time", which is supposed to reduce absenteeism. One company employees have averaged 6.3 days off work in the past. The company introduces "flex–time" and a year later a simple random sample of 100 employees is selected. They average 5.5 days off work with a standard deviation of 2.9. Test to determine if "flex–time" reduces absenteeism. Clearly state the null and alternative hypotheses, calculate the appropriate test statistic, find the P–value, and state your conclusion.

**Show your work!**

1. **(2 Points)** The test that has to be used in this question is a
   **z–test / t–test.**
   Circle your answer and explain briefly why you chose this particular test to answer the question.

2. **(3 Points)** State the null and the alternative hypotheses for this problem, in words and in terms of the box model.

**Please turn over!**

3. **(5 Points)** Calculate the appropriate test statistic.

4. **(4 Points)** Obtain the (approximate) P–value (use the appropriate table!).

5. **(6 Points)** State your conclusions in terms of rejecting (or not rejecting) the null hypothesis and in your own words. (If approriate, also speak of statistically significant or highly statistically significant.)

**Please turn over!**

**Formulas:**

$$\text{box average} = \frac{\text{sum of all numbers in box}}{\text{how many numbers in box}}$$

$$\text{box SD} = \sqrt{\text{average of [(deviations from box average)}^2\text{]}}$$

$$\text{SD+} = \text{SD} \times \sqrt{\frac{\text{number of draws}}{\text{number of draws - 1}}}$$

$$\text{EV}_{sum} = \text{number of draws} \times \text{box average}$$

$$\text{SE}_{sum} = \sqrt{\text{number of draws}} \times \text{box SD}$$

$$\text{EV}_{avg} = \text{box average} \qquad \text{SE}_{avg} = \frac{\text{SE}_{sum}}{\text{number of draws}}$$

Shortcut formulas for a box that contains only *two* different numbers:

$$\text{average} = \frac{(\text{smaller} \times \text{how many}) + (\text{bigger} \times \text{how many})}{\text{how many tickets in the box}}$$

$$\text{SD} = (\text{bigger - smaller}) \times \sqrt{\frac{\text{fraction}}{\text{bigger}} \times \frac{\text{fraction}}{\text{smaller}}}$$

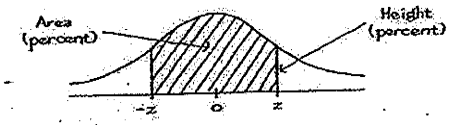
Shortcut formulas for a box that contains only $\boxed{0}$'s and $\boxed{1}$'s:

$$\text{average} = \frac{\text{number of } \boxed{1}\text{'s}}{\text{how many tickets in the box}}$$

$$\text{SD} = \sqrt{\frac{\text{fraction}}{\text{of } \boxed{1}\text{'s}} \times \frac{\text{fraction}}{\text{of } \boxed{0}\text{'s}}}$$

$$\text{EV}_{\%} = \%\text{ of } \boxed{1}\text{'s in the box} \qquad \text{SE}_{\%} = \frac{\text{SE}_{sum}}{\text{number of draws}} \times 100\%$$

# Tables

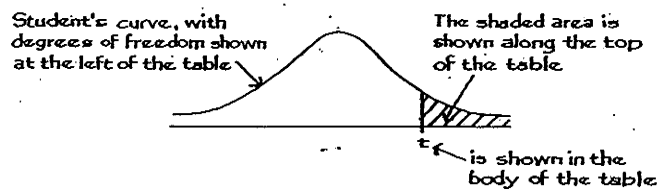



## A NORMAL TABLE

| z | Area | z | Area | z | Area |
|---|---|---|---|---|---|
| 0.00 | 0 | 1.50 | 86.64 | 3.00 | 99.730 |
| 0.05 | 3.99 | 1.55 | 87.89 | 3.05 | 99.771 |
| 0.10 | 7.97 | 1.60 | 89.04 | 3.10 | 99.806 |
| 0.15 | 11.92 | 1.65 | 90.11 | 3.15 | 99.837 |
| 0.20 | 15.85 | 1.70 | 91.09 | 3.20 | 99.863 |
| 0.25 | 19.74 | 1.75 | 91.99 | 3.25 | 99.885 |
| 0.30 | 23.58 | 1.80 | 92.81 | 3.30 | 99.903 |
| 0.35 | 27.37 | 1.85 | 93.57 | 3.35 | 99.919 |
| 0.40 | 31.08 | 1.90 | 94.26 | 3.40 | 99.933 |
| 0.45 | 34.73 | 1.95 | 94.88 | 3.45 | 99.944 |
| 0.50 | 38.29 | 2.00 | 95.45 | 3.50 | 99.953 |
| 0.55 | 41.77 | 2.05 | 95.96 | 3.55 | 99.961 |
| 0.60 | 45.15 | 2.10 | 96.43 | 3.60 | 99.968 |
| 0.65 | 48.43 | 2.15 | 96.84 | 3.65 | 99.974 |
| 0.70 | 51.61 | 2.20 | 97.22 | 3.70 | 99.978 |
| 0.75 | 54.67 | 2.25 | 97.56 | 3.75 | 99.982 |
| 0.80 | 57.63 | 2.30 | 97.86 | 3.80 | 99.986 |
| 0.85 | 60.47 | 2.35 | 98.12 | 3.85 | 99.988 |
| 0.90 | 63.19 | 2.40 | 98.36 | 3.90 | 99.990 |
| 0.95 | 65.79 | 2.45 | 98.57 | 3.95 | 99.992 |
| 1.00 | 68.27 | 2.50 | 98.76 | 4.00 | 99.9937 |
| 1.05 | 70.63 | 2.55 | 98.92 | 4.05 | 99.9949 |
| 1.10 | 72.87 | 2.60 | 99.07 | 4.10 | 99.9959 |
| 1.15 | 74.99 | 2.65 | 99.20 | 4.15 | 99.9967 |
| 1.20 | 76.99 | 2.70 | 99.31 | 4.20 | 99.9973 |
| 1.25 | 78.87 | 2.75 | 99.40 | 4.25 | 99.9979 |
| 1.30 | 80.64 | 2.80 | 99.49 | 4.30 | 99.9983 |
| 1.35 | 82.30 | 2.85 | 99.56 | 4.35 | 99.9986 |
| 1.40 | 83.85 | 2.90 | 99.63 | 4.40 | 99.9989 |
| 1.45 | 85.29 | 2.95 | 99.68 | 4.45 | 99.9991 |



## A *t*-TABLE




| *Degrees of freedom* | *25%* | *10%* | *5%* | *2.5%* | *1%* | *0.5%* |
|---|---|---|---|---|---|---|
| 1 | 1.00 | 3.08 | 6.31 | 12.71 | 31.82 | 63.66 |
| 2 | 0.82 | 1.89 | 2.92 | 4.30 | 6.96 | 9.92 |
| 3 | 0.76 | 1.64 | 2.35 | 3.18 | 4.54 | 5.84 |
| 4 | 0.74 | 1.53 | 2.13 | 2.78 | 3.75 | 4.60 |
| 5 | 0.73 | 1.48 | 2.02 | 2.57 | 3.36 | 4.03 |
| 6 | 0.72 | 1.44 | 1.94 | 2.45 | 3.14 | 3.71 |
| 7 | 0.71 | 1.41 | 1.89 | 2.36 | 3.00 | 3.50 |
| 8 | 0.71 | 1.40 | 1.86 | 2.31 | 2.90 | 3.36 |
| 9 | 0.70 | 1.38 | 1.83 | 2.26 | 2.82 | 3.25 |
| 10 | 0.70 | 1.37 | 1.81 | 2.23 | 2.76 | 3.17 |
| 11 | 0.70 | 1.36 | 1.80 | 2.20 | 2.72 | 3.11 |
| 12 | 0.70 | 1.36 | 1.78 | 2.18 | 2.68 | 3.05 |
| 13 | 0.69 | 1.35 | 1.77 | 2.16 | 2.65 | 3.01 |
| 14 | 0.69 | 1.35 | 1.76 | 2.14 | 2.62 | 2.98 |
| 15 | 0.69 | 1.34 | 1.75 | 2.13 | 2.60 | 2.95 |
| 16 | 0.69 | 1.34 | 1.75 | 2.12 | 2.58 | 2.92 |
| 17 | 0.69 | 1.33 | 1.74 | 2.11 | 2.57 | 2.90 |
| 18 | 0.69 | 1.33 | 1.73 | 2.10 | 2.55 | 2.88 |
| 19 | 0.69 | 1.33 | 1.73 | 2.09 | 2.54 | 2.86 |
| 20 | 0.69 | 1.33 | 1.72 | 2.09 | 2.53 | 2.85 |
| 21 | 0.69 | 1.32 | 1.72 | 2.08 | 2.52 | 2.83 |
| 22 | 0.69 | 1.32 | 1.72 | 2.07 | 2.51 | 2.82 |
| 23 | 0.69 | 1.32 | 1.71 | 2.07 | 2.50 | 2.81 |
| 24 | 0.68 | 1.32 | 1.71 | 2.06 | 2.49 | 2.80 |
| 25 | 0.68 | 1.32 | 1.71 | 2.06 | 2.49 | 2.79 |