Statistics 1040, Section 004, Quiz 1 (20 Points)

Friday, January 14, 2005

Your Name: _____

Question 1: Controlled Experiments/Observational Studies I (**13 Points**)

The Public Health Service studied the effects of smoking on health, in a large sample of representative households. For men and for women in each age group, those who never smoked were on average somewhat healthier than the current smokers, but the current smokers were on average much healthier than those who had recently stopped smoking.

- (**6 Points**) Why did they study men and women and the different age groups separately?

- (**7 Points**) The lesson seems to be that you shouldn't start smoking, but once you've started, don't stop. Comment briefly.

Please turn over!

Question 2: Controlled Experiments/Observational Studies II (**7 Points**)

Fill the gaps in the following statements using the most appropriate words from the list below:

Statisticians want to know the effect of a _____ (like the Salk vaccine) on a response (like getting polio). To find out, they compare the responses of a _____ with a _____.

To make sure that the treatment group is like the control group, investigators put _____ into the treatment or the control group at _____.

Whenever possible, the control group is given a _____, which is neutral but resembles the treatment.

In a _____ experiment, the subjects do not know whether they are in the treatment or in the control group; neither do those who evaluate the responses.

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

Statistics 1040, Section 004, Quiz 2 (20 Points)

Friday, January 21, 2005

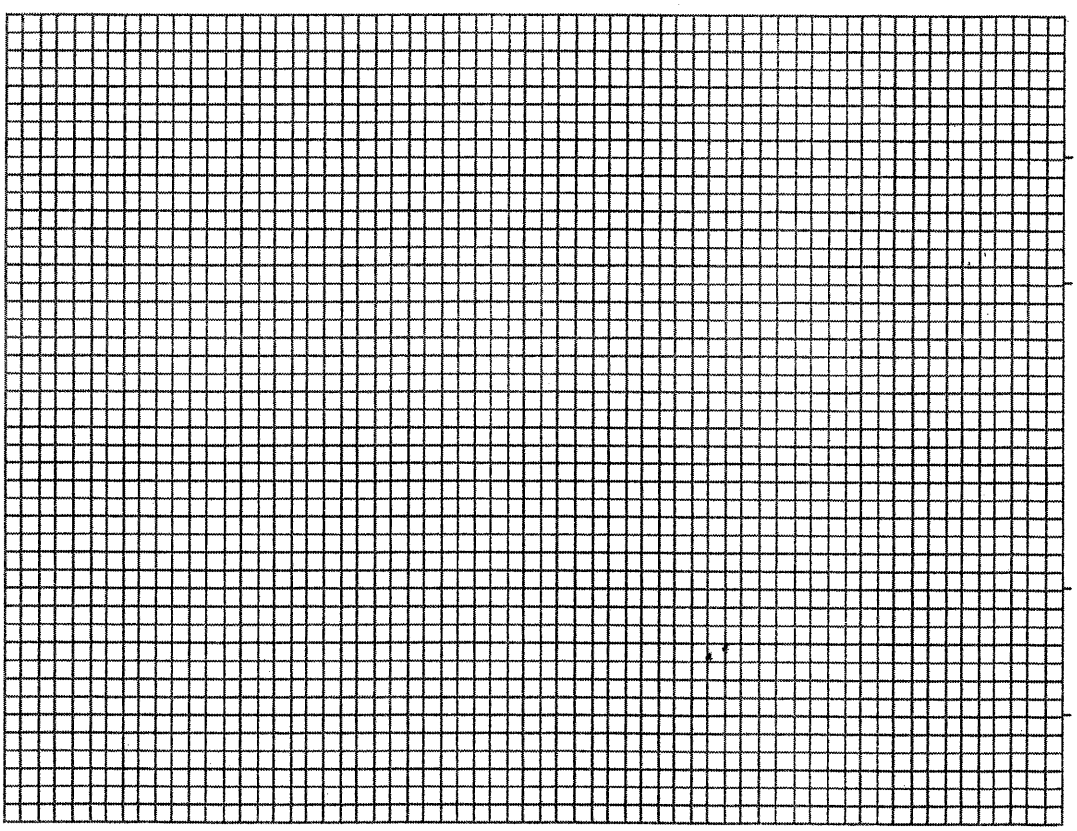
Your Name: _____

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 004, Quiz 3 (20 Points)

Friday, January 28, 2005

Your Name: _____

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

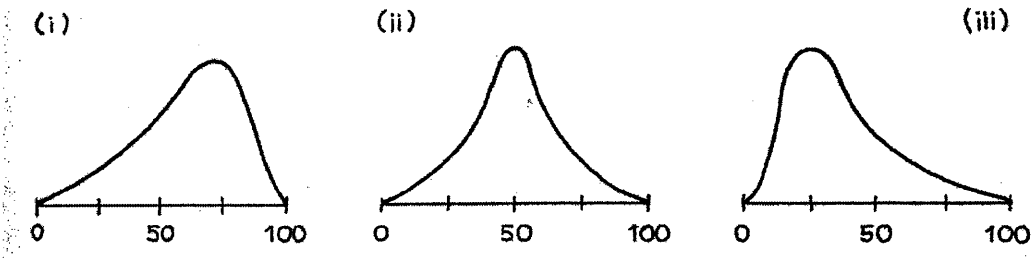
1. **(12 Points)** Find the average, the median, and the standard deviation of the following list of numbers:

Numbers	Average	Median	Standard deviation
-8, 8, 8, -8	_____	_____	_____

Show your work and/or give a short explanation for your answer! Use the formulas provided on the back.

Please turn over!

2. **(8 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).

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 004, Quiz 4 (20 Points)

Friday, February 4, 2005

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 428,000 examinees who took the General GRE Test in 2001–02, the mean for the verbal ability portion of the exam was around 470 and the standard deviation was around 125 (http://ftp.ets.org/pub/gre/994950.pdf). **Show your work!**

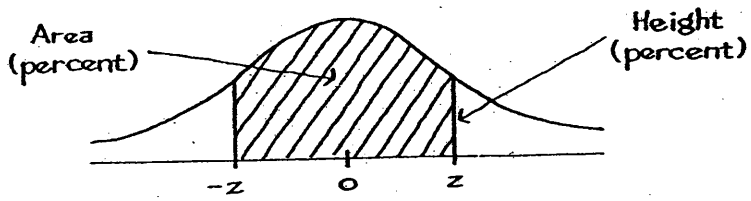
- (**7 Points**) The percentage of examinees who scored **more than 670** on the GRE test is roughly _____ %.

- (**7 Points**) The percentage of examinees who scored **between 320 and 570** is about _____ %.

- (**6 Points**) In order to be among the top 10%, 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
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

Statistics 1040, Section 004, Quiz 5 (20 Points)

Friday, February 11, 2005

Your Name: _____

Question 1: Change Of Scale (**12 Points**)

Conversion of temperature from Celsius to Fahrenheit is another example of what statisticians call **change of scale**. The formula for conversion is

$$F^\circ = \frac{9}{5}C^\circ + 32^\circ.$$

A group of people have an average body temperature of 37.0° Celsius, with a standard deviation of 0.2° Celsius.

1. (**8 Points**) If we translate these results into degrees Fahrenheit, the average temperature would be _____ degrees Fahrenheit, with a standard deviation of _____ degrees Fahrenheit.

2. (**4 Points**) Someone's temperature is 1.5 standard deviations above average on the Celsius scale. When converting this temperature to standard units for an investigator who is using the Fahrenheit scale, we have to report _____ standard units to this investigator.

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

1. (**4 Points**) If women always marry men who were five years older, the correlation between ages of husbands and wives would be _____. **Choose one of the options below, and explain.**

2. (**4 Points**) In reality, the correlation between ages of husbands and wives in the US is _____. **Choose one of the options below, and explain.**

Options: (a) exactly –1 (b) close to –1 (c) close to 0
(d) close to 1 (e) exactly 1

Statistics 1040, Section 004, Quiz 6 (20 Points)

Friday, February 25, 2005

Your Name: _____

Question 1: The Regression Line (**20 Points**)

In a study, reading comprehension is tested for a large number of third grade students, once at the beginning of the school year and once at the end of the school year. During the school year, the students work on reading comprehension skills. The following results are obtained:

beginning–of-year:	average score = 75;	SD = 15;	
end–of–year:	average score = 80;	SD = 17;	$r = 0.6$.

The scatterplot of the data shows a football–shaped cloud. **Show your work!**

1. (**10 Points**) Find the equation of the regression line for predicting the end–of–year score from the beginning–of–year score.

2. (**5 Points**) Use the regression equation from part 1. to predict the end–of–year score for a student who scored 85 on the beginning–of–year test.
   The predicted end–of–year score is: _____

3. (**5 Points**) Find the r.m.s. error for predicting the end–of–year score from the beginning–of–year score.
   The r.m.s. error is: _____

Please turn over!

Formulas:

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

$$\text{slope} = r \times \frac{\text{SD}_y}{\text{SD}_x}$$

$$\text{intercept} = \text{avg}_y - \text{slope} \times \text{avg}_x$$

Statistics 1040, Section 004, Quiz 7 (20 Points)

Friday, March 4, 2005

Your Name: _____

Question 1: Chance/Probability I (**15 Points**)

In a box of 15 chocolates, 5 are mint, 3 are orange, 5 are caramel, and 2 are cherry. I choose two chocolates at random (without replacement!).
Show your work!

1. (**5 Points**) What is the chance that the first is mint or orange?
   The chance is _____ %.

2. (**5 Points**) What is the chance that the first two are both orange?
   The chance is _____ %.

3. (**5 Points**) What is the chance that the first is orange and the second is caramel?
   The chance is _____ %.

Please turn over!

Question 2: Chance/Probability II (**5 Points**)

A coin is tossed six times. Two possible sequences of results are

(i) H T T H T H (ii) H H H H H H

(The coin must land on H or T in the order given; H = heads, T = tails).

Which of the following is correct?

Circle your answer and explain:

1. Sequence (i) is more likely.
2. Sequence (ii) is more likely.
3. Both sequences are equally likely.

Statistics 1040, Section 004, Quiz 8 (20 Points)

Friday, March 11, 2005

Your Name: _____

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

A game consists of tossing an 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 an odd number (i.e., 1, 3, 5, 7, or 9) you lose \$2, otherwise you you win \$1, except when the die lands on 10, in which case you win (or lose) nothing (\$0). Assume you are playing the game 100 times.

1. (**4 Points**) Find the box model.

2. (**6 Points**) Find the expected value of your gain/loss. It is _____

3. (**6 Points**) Find the standard error of your gain/loss. It is _____

Please turn over!

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

A box contains 10,000 tickets: 4,000 $\boxed{0}$'s and 6,000 $\boxed{1}$'s. And 10,000 draws will be made at random with replacement from this box. Which of the following best describes the situation, and why? **Circle your answer and explain briefly.**

1. The number of 1's will be 6,000 exactly.
2. The number of 1's is very likely to equal 6,000, but there is also some small chance that it will not be equal to 6,000.
3. The number of 1's is likely to be different from 6,000, but the difference is likely to be small compared to 10,000.

Formulas:

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

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

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

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

Statistics 1040, Section 004, Quiz 9 (20 Points)

Friday, March 25, 2005

Your Name: _____

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

Suppose it is known that 10% of all people in Utah have a specific blood type. Suppose I take a random sample of 500 Utah residents ... **Show your work!**

1. (**4 Points**) Find the box model.

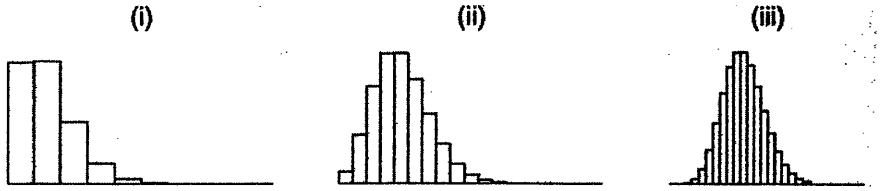
2. (**6 Points**) The expected number of Utah residents in this sample of 500 who have that specific blood type is _____ with an SE of _____.

3. (**6 Points**) The chance that **fewer than** 40 Utah residents in this sample have that blood type is about _____ %.

Please turn over!

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

Shown below are probability histograms for the sum of (a) 100, (b) 400, and (c) 900 draws from the box $\boxed{99 \times \boxed{0} \quad 1 \times \boxed{1}}$. Which histogram is which? **Explain briefly.**



(i) goes with sum _____

(ii) goes with sum _____

(iii) goes with sum _____

Explanation:

Formulas:

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

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

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

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

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

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

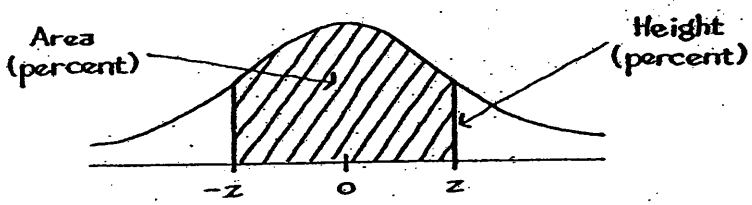
$$\text{SD} = (\text{bigger - smaller}) \times \sqrt{\frac{\text{fraction}}{\text{bigger}} \times \frac{\text{fraction}}{\text{smaller}}}$$

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



A NORMAL TABLE

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0.60	45.15	2.10	96.43	3.60	99.968
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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

Statistics 1040, Section 004, Quiz 10 (20 Points)

Friday, April 8, 2005

Your Name: _____

Question 1: Confidence Intervals (**20 Points**)

Are you sad to see USU President Kermit Hall leave?

This question has been inspired by the Utah Statesman's poll of 1/27/2005, but the numbers are hypothetical.

There are approximately 20,000 students at USU. A simple random sample of 300 USU students was asked the question: "Are you sad to see USU President Kermit Hall leave?". We learn that 100 students from this sample answered: "No, I didn't like what he did for the university."

1. (**14 Points**) If possible, construct a 95% confidence interval for the percentage of all USU students who were not sad to see President Hall leave, because they didn't like what he did for the University. If you cannot construct such a CI, explain why not.

   Show your work.

2. (**6 Points**) Suppose that in the sample of 300 students, 298 students were "not sad to see President Hall leave, because they didn't like what he did for the University". Would it still be possible to construct a 95% confidence interval for the percentage of all USU students who were not sad to see President Hall leave?
   Yes, possible or **No, not possible**? Why or why not? Explain!

   You do not have to actually construct this confidence interval, but you do have to show calculations necessary to support your answer.

Please turn over!

Formulas:

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

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

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

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

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:

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

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

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

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

Statistics 1040, Section 004, Quiz 11 (20 Points)

Friday, April 15, 2005

Your Name: _____

Question 1: Confidence Intervals for Averages (**20 Points**)

A telephone answering service, at the end of each call, completes a report in which the length of the call is recorded. A simple random sample of 150 reports yields a mean length per call of 1.2 minutes with a standard deviation of 0.4 minutes.

1. (**12 Points**) Construct a 95% confidence interval for the average length of all the calls handled by the answering service.

2. (**5 Points**) Because some of the calls are quite lengthy, call length does not follow the normal curve; it has a long right tail. Does this mean that your confidence interval calculated above is incorrect? **Yes, incorrect** or **No, correct**. Circle your answer and explain briefly.

3. (**3 Points**) **True** or **False** (circle your choice – no further explanation needed): 95% of the calls received by the answering service have a length that falls between the lower limit and the upper limit of the confidence interval calculated in part 1. above.

Please turn over!

Formulas:

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

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

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

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

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

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:

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

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

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

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

Statistics 1040, Section 004, Quiz 12 (20 Points)

Friday, April 22, 2005

Your Name: _____

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

Past experience indicates that the time for high school seniors to complete a standardized test follows a normal distribution with a mean of 35 minutes. A simple random sample of 20 high school seniors was taken and it was found that on average, it took them 33.1 minutes to complete this test, with a standard deviation of 4.3 minutes.

Make an appropriate test to see whether or not these data suggest that the mean time needed by high school seniors to complete this test is **different from** 35 minutes.

Show your work!

1. (3 Points) State the null and the alternative hypothesis for this problem, in words and in terms of the box model.

2. (5 Points) Calculate the appropriate test statistic.

Please turn over!

3. (4 Points) Obtain the (approximate) P–value (use the appropriate table!).

4. (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.)

5. (2 Points) Explain briefly why you chose this particular test to answer the question.

Memory Aids

Please note that these are provided for your convenience, but it is your responsibility to know how and when to use them.

$$\text{rms error} = \sqrt{1 - r^2} \times SD_Y$$

$$\text{slope} = r \times \frac{SD_Y}{SD_X}$$

$$\text{intercept} = \text{ave}_Y - \text{slope} \times \text{ave}_X$$

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

$$SD_{\text{box}} = \sqrt{\text{fraction of 0's} \times \text{fraction of 1's}}$$

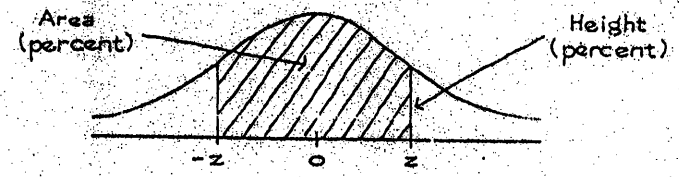
$EV_{\text{sum}} =$ number of draws $\times$ ave_{box}
$SE_{\text{sum}} = \sqrt{\text{number of draws}} \times SD_{\text{box}}$

$EV_{\text{ave}} = \text{ave}_{\text{box}}$
$SE_{\text{ave}} = \dfrac{SE_{\text{sum}}}{\text{number of draws}}$

$EV_{\%} =$ % of 1's in the box
$SE_{\%} = \left(\dfrac{SE_{\text{sum}}}{\text{number of draws}}\right) \times 100\%$

$SE_{\text{diff}} = \sqrt{a^2 + b^2}$ where a is the SE for the first quantity,
b is the SE for the second quantity, and the two quantities are independent

A NORMAL TABLE



z	Area	z	Area	z	Area
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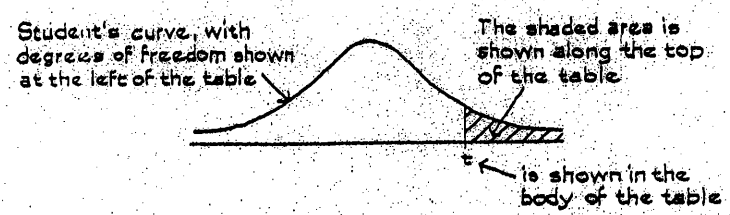
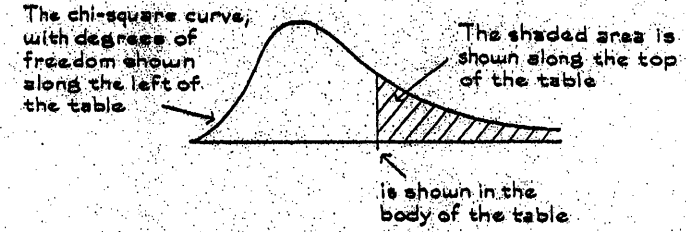
0.15	11.92	1.65	90.11	3.15	99.837
0.20	15.85	1.70	91.09	3.20	99.863
0.25	19.74	1.75	91.99	3.25	99.885
0.30	23.58	1.80	92.81	3.30	99.903
0.35	27.37	1.85	93.57	3.35	99.919
0.40	31.08	1.90	94.26	3.40	99.933
0.45	34.73	1.95	94.88	3.45	99.944
0.50	38.29	2.00	95.45	3.50	99.953
0.55	41.77	2.05	95.96	3.55	99.961
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

A CHI-SQUARE TABLE



Degrees of freedom	*99%*	*95%*	*90%*	*70%*	*50%*	*30%*	*10%*	*5%*	*1%*
1	0.00016	0.0039	0.016	0.15	0.46	1.07	2.71	3.84	6.64
2	0.020	0.10	0.21	0.71	1.39	2.41	4.60	5.99	9.21
3	0.12	0.35	0.58	1.42	2.37	3.67	6.25	7.82	11.34
4	0.30	0.71	1.06	2.20	3.36	4.88	7.78	9.49	13.28
5	0.55	1.14	1.61	3.00	4.35	6.06	9.24	11.07	15.09
6	0.87	1.64	2.20	3.83	5.35	7.23	10.65	12.59	16.81
7	1.24	2.17	2.83	4.67	6.35	8.38	12.02	14.07	18.48
8	1.65	2.73	3.49	5.53	7.34	9.52	13.36	15.51	20.09
9	2.09	3.33	4.17	6.39	8.34	10.66	14.68	16.92	21.67
10	2.56	3.94	4.86	7.27	9.34	11.78	15.99	18.31	23.21
11	3.05	4.58	5.58	8.15	10.34	12.90	17.28	19.68	24.73
12	3.57	5.23	6.30	9.03	11.34	14.01	18.55	21.03	26.22
13	4.11	5.89	7.04	9.93	12.34	15.12	19.81	22.36	27.69
14	4.66	6.57	7.79	10.82	13.34	16.22	21.06	23.69	29.14
15	5.23	7.26	8.55	11.72	14.34	17.32	22.31	25.00	30.58
16	5.81	7.96	9.31	12.62	15.34	18.42	23.54	26.30	32.00
17	6.41	8.67	10.09	13.53	16.34	19.51	24.77	27.59	33.41
18	7.00	9.39	10.87	14.44	17.34	20.60	25.99	28.87	34.81
19	7.63	10.12	11.65	15.35	18.34	21.69	27.20	30.14	36.19
20	8.26	10.85	12.44	16.27	19.34	22.78	28.41	31.41	37.57

Source: Adapted from p. 112 of Sir R. A. Fisher, *Statistical Methods for Research Workers* (Edinburgh: Oliver & Boyd, 1958).