Stat 1040:

Quizzes, Fall 2002

Statistics 1040, Section 006, Quiz 1 (20 Points)

September 6, 2002

Your Name: _____

Question 1: Observational Studies and Experiments **(12 Points)**

According to a study done at Kaiser Permanente in Walnut Creek, California, users of oral contraceptives have a higher rate of cervical cancer than non–users, even after adjusting for age, education, and marital status. Investigators concluded that the pill causes cervical cancer. Answer the following three questions:

1. Is this a contolled experiment or an observational study? Circle your answer.

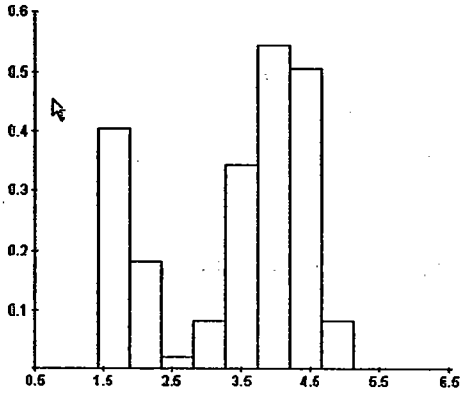
2. Why did the investigators adjust for age, education, and marital status?

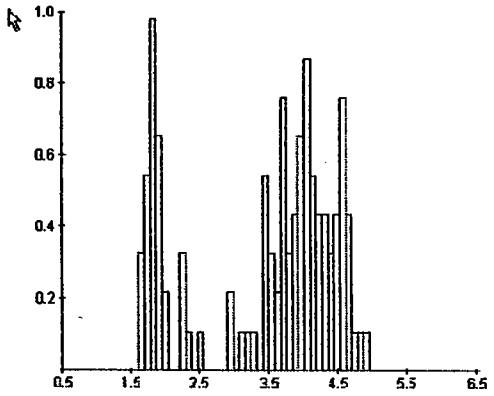
3. Were the conclusions of the study justified by the data? Answer yes or no, and explain briefly.

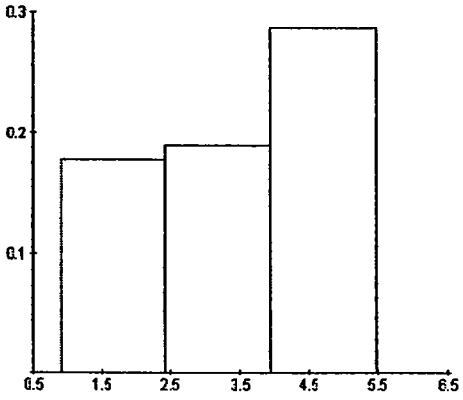
Please turn over!

Question 2: Histograms (8 Points)

The following three histograms are based on the Old Faithful data set. The observations are the duration (in minutes) for eruptions of the Old Faithful geyser in Yellowstone National Park. There exist two types of eruptions: shorter ones (about 2 minutes) and longer ones (about 4 minutes). Which of the three histograms best describes the underlying data. Shortly explain your answer and indicate why you think the other 2 histograms don't represent the data as well as the one you have selected.







Statistics 1040, Section 006, Quiz 2 (20 Points)

September 13, 2002

Your Name: _____

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

The table below, published in USA Today on Friday, May 15, 1998, lists the 15 most widely held stocks and their change year–to–date (YTD). Suppose we hold one share each of AT&T (-6.5), Bell Atlantic (+0.1), Coca–Cola (+16.6), Merck (+11.4), and SBC Comm. (+3.4).

1. Find the **average change** (YTD) for the 5 stocks we own. **Show your work!**

MOST WIDELY HELD STOCKS

Stock	Thurs.	Chg.	Pctg. Change Day	YTD
AT&T	$57 5/16	–15/16	–1.6	–6.5
Ameritech	$43 1/4	–1/4	–0.6	+7.5
Bell Atlantic	$91 1/8	–1 1/16	–1.2	+0.1
BellSouth	$68 3/16	+1 9/16	+2.3	+21.1
Coca-Cola	$77 1/4	+1/2	+0.6	+16.6
Compaq	$31 9/16	–5/16	–1.0	+11.7
Exxon	$73 5/8	unch.	—	+20.3
GE	$84 1/8	–1/2	–0.6	+14.7
Intel	$84 9/16	–1/4	–0.3	+20.4
IBM	$125 13/16	+3 15/16	+3.2	+20.3
Johnson & John.	$72 9/16	–1/4	–0.3	+9.6
Lucent	$71 5/16	–13/16	–1.1	+78.3
Merck	$118 1/16	+1 1/16	+0.6	+11.4
Microsoft	$88 15/16	+2	+2.3	+37.6
SBC Comm.	$37 1/8	–3/16	–0.5	+3.4

Stocks included are those held by the largest number of accounts at Merrill Lynch.

2. Find the **median change** (YTD) for the 5 stocks we own.

Please turn over!

3. Find the **standard deviation of the changes** (YTD) for the 5 stocks we own. **Show your work!**

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 006, Quiz 3 (20 Points)

Sepyember 20, 2002

Your Name: _____

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

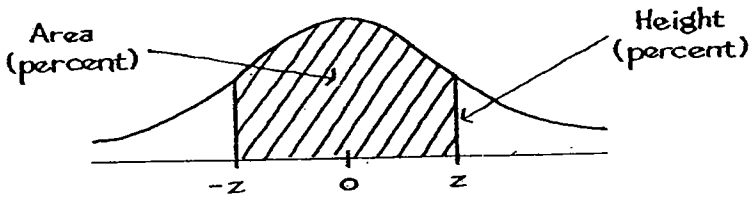
Car drivers in the United States average 12,400 miles a year, nearly 50 percent more than European drivers (*The Economist*, June 22, 1996). Assume that the number of yearly miles by U.S. drivers approximately follows a normal curve with a standard deviation of 3,200 miles.

1. Determine the percentage of drivers who travel between 10,000 and 15,000 miles in a year.

2. And what percentage of drivers travels more than 30,000 miles in a year?

Show your work!

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 006, Quiz 4 (20 Points)

September 27, 2002

Your Name: _____

Question 1: Percentiles and the Normal Curve **(12 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 all college seniors and graduates who took the exam in the past few years, the mean score for the verbal ability portion of the exam was 497 with a standard deviation of 115. Assuming the scores are bell–shaped, fill in the blanks below. **Show your work!**

1. A student who received a score of 650 on the verbal ability portion of the GRE exam was at the _____ th percentile of the score distribution.

2. A graduate school program in English will admit only students with GRE verbal ability scores in the top 30%. Therefore, the lowest GRE score they will accept is _____.

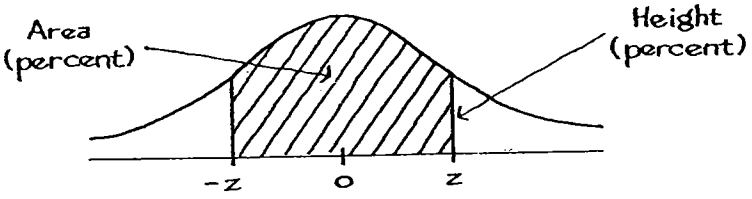
Question 2: Correlation **(8 Points)**

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

2. The correlation between the ages of husbands and wives in the U.S. is _____. Choose one option, and explain.

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

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
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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
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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 006, Quiz 5 (20 Points)

October 11, 2002

Your Name: _____

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

In one study, the correlation between the educational level of husbands and wives in a certain town was about 0.50; both averaged 12 years of schooling completed, with an SD of 3 years.

1. Find the regression equation for predicting the educational level of a wife from the educational level of her husband. (10 Points)

2. Use the regression equation from part 1. to predict the educational level of a woman whose husband has completed 18 years of schooling. (5 Points)

3. Find the r.m.s. error for predicting the wife's educational level from the educational level of her husband. (5 Points)

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 006, Quiz 6 (20 Points)

October 18, 2002

Your Name: _____

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

1. A deck of 52 cards is shuffled and two cards are drawn without replacement.

   (a) (**3 Points**) What is the chance that the first card is a ♡ or a ♢?

   (b) (**4 Points**) What is the chance that the first card is a ♡ and the second card is a ♢ ?

   (c) (**4 Points**) What is the chance that both cards are ♡ ?

   (d) (**4 Points**) What is the chance that neither card is a ♡?

2. (**5 Points**) There are two options:

   (a) You toss a coin 100 times; on each toss, if it lands heads you win \$1, if it lands tails you lose \$1.

   (b) You draw 100 times at random with replacement from the box $\boxed{\boxed{1}\boxed{0}}$. On each draw, you are paid (in dollars) the number on the ticket.

   Which option is better? Or are they the same? Explain briefly.

Statistics 1040, Section 006, Quiz 7 (20 Points)

October 25, 2002

Your Name: _____

Question 1: Box Models, EV, and SE **(15 Points)**

A large group of people get together. Each one rolls a die 180 times and counts the number of ones. **Show your work!**

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

2. **(5 Points)** Find the expected value for the number of ones.

3. **(6 Points)** Find the standard error.

Please turn over!

Question 2: Law of Averages **(5 Points)**

The meaning of "The probability of a Head is 1/2" in tossing a coin is best expressed by saying:

1. The coin has only two sides, so the chance of each is 1/2.
2. The coin will come up Heads exactly half the time: 50 Heads in 100 tosses, 500 Heads in 1000 tosses, and so on.
3. The odds against a Head are 2 to 1.
4. The fraction of tosses that come up Head will get ever closer to 1/2 as more tosses are made,

Explain your answer!

Formulas:

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

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

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

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

Statistics 1040, Section 006, Quiz 8 (20 Points)

November 1, 2002

Your Name: _____

Question 1: EV, SE, and Normal Curve **(20 Points)**

According to the U.S. Census Bureau, 68% of Utah residents are 18 years of age or older. Suppose that 200 Utah residents have been randomly chosen to participate in a survey.

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

2. **(8 Points)** Find the expected number of Utah residents in this sample of 200 who are 18 years of age or older. What is the corresponding SE?

3. **(8 Points)** Using the normal curve, find the chance that **at least** 130 of the Utah residents in the sample are 18 years of age or older.

Please turn over!

Formulas:

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

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

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

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

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

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

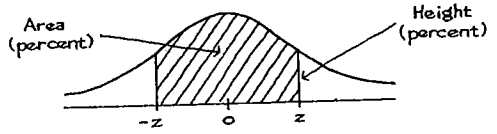
$$\text{SD} = (\text{bigger - smaller}) \times \sqrt{\frac{\text{fraction}}{\text{bigger}} \times \frac{\text{fraction}}{\text{smaller}}}$$

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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1.05	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
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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 6, Quiz 9 (20 Points)

November 15, 2002

Your Name: _____

Question 1: $EV_{\%}$, $SE_{\%}$, and Normal Curve (**20 Points**)

A group of 50,000 tax forms has an average gross income of \$37,000, with an SD of \$20,000. Furthermore, 20% of the forms have a gross income over \$50,000. A group of 900 forms is chosen at random for audit. Estimate the chance that between 19% and 21% of the forms chosen for audit have gross income over \$50,000. **Show your work!**

Please turn over!

Fo ılas:

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

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

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

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

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:

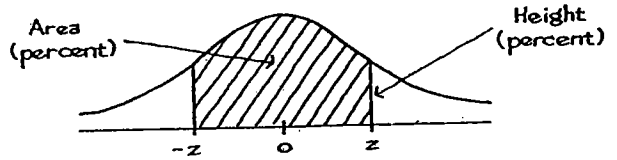
$$\text{average} = \frac{\text{number of } \boxed{1}\text{'s}}{\text{how many tickets in the box}}$$

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

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

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

Tables



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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
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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 006, Quiz 10 (20 Points)

November 22, 2002

Your Name: _____

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

A real estate office wants to make a survey in a certain town, which has 50,000 households, to determine how far the head of household has to commute to work. A simple random sample of 1,000 households is chosen, the occupants are interviewed, and it is found that on average, the heads of the sample households commuted 8.7 miles to work; the SD of the distances was 9.0 miles. (All distances are one–way; if someone isn't working, or is working at home, the commute distance is defined to be 0.)

Fill the blanks in the statements below and **show your work!**

1. (**10 Points**) The average commute distance of all 50,000 heads of households in the town is estimated as _____, and this estimate is likely to be off by _____ or so.

2. (**10 Points**) If possible, find a 95%–confidence interval for the average commute distance of all heads of households in the town. If this isn't possible, explain why not.

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:

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

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

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

Statistics 1040, Section 006, Quiz 11 (20 Points)

December 2, 2002

Your Name: _____

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

Bookstores like education, because national data show that 71% of college graduates have read a book in the past year, compared to 54% of the general population age 18 and over. The data also show the nationwide average educational level to be 13 years of schooling completed, with an SD of about 3 years, for persons age 18 and over.
A bookstore is doing a market survey in a certain county, and takes a sample of 1,000 people age 18 and over. They find the average educational level to be 14 years, and the SD is 5 years. Can the difference in average educational level between the sample and the nation be explained by chance variation? If not, what other explanations can you give? Please **follow the steps below** in answering these questions.

1. (5 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.

3. (5 points) Obtain the P–value (use the normal table on the back).

4. (5 points) State conclusions in terms of rejecting the null hypothesis and in your own words.

Please turn over!

Formulas:

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

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

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

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

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

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

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

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

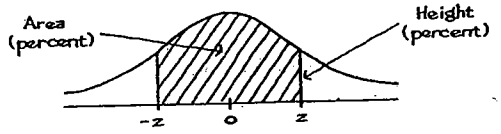
Shortcut formulas for a box that contains only $\boxed{0}$'s and $\boxed{1}$'s:

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

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

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

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

Statistics 1040, Section 006, Quiz 12 (20+ Points)

Due on or before December 11, 2002

Your Name: _____

This is a take–home quiz. You should work on it on your own and bring it to me on or before the final examination day. Please work on this quiz independently, getting as little help as possible from your friends, books, and notes.

Question 1:

(20 Points) A thermostat used in an electrical device is to be checked for the accuracy of its design setting of 200 degrees Fahrenheit. Ten thermostats were tested to determine their actual setting, resulting in the following data:

202.2	203.4	200.4	202.5	206.3	198.0	203.7	200.8	201.3	199.0

Is the mean setting of these thermometers different from 200 degrees Fahrenheit? State the null and the alternative hypothesis, calculate test statistic (after finding the average and SD of the sample), obtain the P–value, and clearly state your conclusions. Assume that the thermometer settings follow the normal curve.

The following questions are extra–credit questions. You may obtain a maximum of 20 extra–points if you complete both questions.

Question 2:

(10 Points) In an experiment to study the dependence of hypertension on smoking habits, the following data were taken on 180 individuals:

	Nonsmokers	Moderate Smokers	Heavy Smokers
Hypertension	21	36	30
No hypertension	21	26	21

Is the presence or absence of hypertension independent of smoking habits? Conduct an appropriate statistical test to answer this question.

Question 3:

(10 Points) A study was made to estimate the difference in salaries of college professors in private and state colleges of North Carolina. A random sample of 100 professors in private colleges showed an average 9–month salary of \$32,000 with a standard deviation of \$1300. A random sample of 200 professors in state colleges showed an average salary of \$32,900 with a standard deviation of \$1400. Is there any statistical evidence that professors in state colleges have **higher average salaries** than professors in private colleges? Conduct an appropriate statistical test to answer this question.