

Name or Number:

Stat 1040, Spring 2009, Midterm 2

Show your work. The test is out of 100 points and you have 50 minutes, so budget your time accordingly.

1. (16 points) A box contains 2 red marbles and 8 blue marbles. For parts (a) through (d), assume we draw 2 marbles **WITH** replacement from the box. For parts (e) through (h), assume we draw 2 marbles **WITHOUT** replacement from the box.

- (a) What is the chance that both of the marbles are blue?

$$\left(\frac{8}{10}\right)\left(\frac{8}{10}\right)$$

- (b) What is the chance that at least one of the marbles is red?

$$1 - \text{chance both are blue} = 1 - \text{answer to (a)} \\ = 1 - \left(\frac{8}{10}\right)\left(\frac{8}{10}\right)$$

- (c) What is the chance that one of the marbles is blue and the other is red?

$$\left(\frac{8}{10}\right)\left(\frac{2}{10}\right) + \left(\frac{2}{10}\right)\left(\frac{8}{10}\right)$$

- (d) What is the chance the second marble is blue?

$$\frac{8}{10}$$

- (e) What is the chance that both of the marbles are blue?

$$\left(\frac{8}{10}\right)\left(\frac{7}{9}\right)$$

- (f) What is the chance that at least one of the marbles is red?

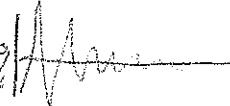
$$1 - \text{answer to (e)} = 1 - \left(\frac{8}{10}\right)\left(\frac{7}{9}\right)$$

- (g) What is the chance that one of the marbles is blue and the other is red?

$$\left(\frac{8}{10}\right)\left(\frac{2}{9}\right) + \left(\frac{2}{10}\right)\left(\frac{8}{9}\right)$$

- (h) What is the chance the second marble is blue?

$$\frac{8}{10}$$

63% 

2. In the 2008 Presidential election, 63% of Utah voters voted for McCain. In each case, circle the correct answer. (2 points each)

- (a) If we want to get 65% or more McCain voters, should we take a simple random sample of 100 or 300 Utah voters?
- (b) If we want to get between 60% and 65% McCain voters, should we take a simple random sample of 100 or 300 Utah voters?
- (c) If we want to get less than 65% McCain voters, should we take a simple random sample of 100 or 300 Utah voters?
- (d) If we want to get less than 60% McCain voters, should we take a simple random sample of 100 or 300 Utah voters?

3. For each of the following answer True or False. (2 points each)

- (a) If we toss a coin 10 times, we will almost always get 5 heads. TRUE or FALSE?
- (b) A large sample can be less accurate than a small sample. TRUE or FALSE?
- (c) The law of averages says that as we toss a coin more and more times, the chance of getting exactly 50% heads will get larger and larger. TRUE or FALSE?
- (d) If a 95% confidence interval goes from 2.8 to 3.3, we know that about 95% of the tickets in the box will be between 2.8 and 3.3. TRUE or FALSE?
- (e) For simple random samples, if we want twice the accuracy, we should sample twice as many people. TRUE or FALSE?
- (f) If a sample is large enough, the histogram for the sample will always follow the normal curve. TRUE or FALSE?

*the sample may be incomes, o/1's, etc.*

4. (12 points) A simple random sample of 1000 Cache Valley voters shows that 258 of them voted for Obama in the 2008 Presidential election. Find a 90% confidence interval for the percentage of all Cache Valley voters who voted for Obama in the 2008 Presidential election.

sample percentage =  $\frac{258}{1000} \times 100\% = 25.8\%$

bootstrap:  $\frac{742}{1000} \frac{258}{1000}$  or  $\frac{740}{1000} \frac{260}{1000}$  ave box = ?  
SD<sub>box</sub> = ?  $\approx 144$

$SE_{sum} = \sqrt{1000} (.44) = 13.9$

$SE_{\%} = \frac{13.9}{1000} \times 100\% = 1.39\%$

CI:  $25.8\% \pm 1.65(1.39\%)$  i.e.  $25.8\% \pm 2.3\%$

23.5% to 28.1% ANS.



5. A simple random sample of 250 high school students from a school district has an average ACT score of 24.5 with an SD of 4.8.

(a) (12 points) Find a 95% confidence interval for the average ACT score for all high school students from that school district.

bootstrap  $\underbrace{\quad\quad\quad}_{??}$ ,  $SD_{box} = ? \approx 4.8$

$$SE_{sum} = \sqrt{250} (4.8) = 75.9$$

$$SE_{ave} = \frac{75.9}{250} = .30$$

CI:  $24.5 \pm 2(.30)$  i.e.  $24.5 \pm .6$  23.9 to 25.1 ANS.

(b) (3 points) Do we need to know the ACT scores follow the normal curve to answer part (a)? Why or why not?

No, because we have a large number of draws (250).

6. National data show that the average weight of 15-year-old girls is 125.5 pounds with an SD of 25.1 pounds.

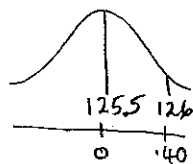
(a) (12 points) If we take a simple random sample of 400 15-year-old girls, what is the chance that the average of the sample will be more than 126.0 pounds?

weights  $ave_{box} = 125.5$   
 $SD_{box} = 25.1$

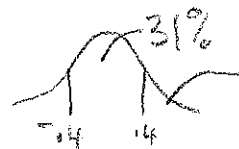
$$EV_{ave} = 125.5$$

$$SE_{sum} = \sqrt{400} (25.1) = 502$$

$$SE_{ave} = \frac{502}{400} = 1.255$$



$$z = \frac{126 - 125.5}{1.255} = .40$$



ANS.

$$\frac{100 - 31}{2} = \underline{\underline{34.5\%}}$$

(b) (3 points) The weights do not follow the normal curve. Is this a problem for your answer to part (a)? Explain briefly.

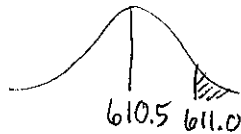
It is not a problem because the number of draws is large (400) so the average will follow the normal curve even if the tickets themselves do not.

7. (12 points) A large batch of tennis balls weigh an average of 2.035 ounces with an SD of .015 ounces. If I take a simple random sample of 300 tennis balls, what is the chance that they weigh more than 611.0 ounces?

$$\begin{aligned} \text{ave}_{\text{box}} &= 2.035 \\ \text{SD}_{\text{box}} &= .015 \end{aligned}$$

$$\begin{aligned} EV_{\text{sum}} &= 300(2.035) \\ &= 610.5 \end{aligned}$$

$$\begin{aligned} SE_{\text{sum}} &= \sqrt{300}(.015) \\ &= .26 \end{aligned}$$



$$z = \frac{611.0 - 610.5}{.26} = 1.92$$



8. A bookstore wants to survey their customers to find out whether they are satisfied with the store's selection of books. To collect their sample, they print out a special coupon that they hand out with every cash register receipt for a month, asking the customer to call a special toll-free number to take the survey and be entered to win a prize.

- (a) (2 points) Will this give a simple random sample of customers? Explain briefly.

No - it is not random (a sample of convenience)

- (b) (6 points) Give THREE different ways in which you expect the people who take the survey to be different from the rest of the bookstore's customers.

Those who take the survey are likely to be less busy than those who don't

" " " " more opinionated "

" " " " more dissatisfied "

" " " " more organized "

Compulsive, conscientious, etc.

- (c) (2 points) Suppose that 90% of the customers who take the survey are not satisfied with the store's selection of books. Is this an accurate estimate of the percentage of all the bookstore's customers that are not satisfied with the store's selection of books? Explain briefly.

No, because as indicated in (b), the ones who respond may be the ones who are dissatisfied, or who differ in other ways from those who do not respond.