1. It's a family tradition: your professor goes to Las Vegas every year for Thanksgiving .A new casino has opened and they are playing a modified roulette game that has 40 possible numbers that can be spun on a wheel. To play you bet \$2 and you get to choose 8 numbers. If the wheel lands on any number that you chose, you win \$3. If the wheel does not land on a number you chose but on one of 4 "special numbers" you don't win or lose anything. If the wheel lands on any of the remaining numbers (not the ones you choose or the "special numbers"), you lose your bet of \$2. Suppose the typical person plays 25 times.

a. This game of modified roulette can be represented by a box model, please construct a reasonable one in the space below (6 points)

$$\boxed{\begin{array}{ccc} \boxed{+3} & \boxed{0} & \boxed{-2} \\ .2 & .1 & .7 \end{array}}$$

b. The 25 plays can be treated like a random sample of size 25. Find the expected value of this game. (4 points)

$$EV = 25 \times (-.8) = -20$$

c. Find the standard error of this game. (4 points)

$$SE = \sqrt{25} \times \sqrt{(.2)(3--.8)^2+(.1)(0--.8)^2+(.7)(-2--.8)^2}$$

$$\cong 9.95$$

d. Suppose the professor decides to spend \$50 playing a total of 25 times and she lost all of her money. Calculate the chance that your professor could lose at least \$50 playing this game. Show all of your work and answer this question – based on your calculations is she unlucky (let's suppose unlucky means the chance of losing at least \$50 is less than 5%)? (6 points)

$$z = \frac{-50-(-20)}{9.95} \cong -3.0$$

area is < 1%

so <u>unlucky</u>

2. A study was conducted on the sleep patterns of infants in the United States. A sample of 16 infants was drawn at random with an average hours slept of 14 hours in a 24-hour period. Suppose the standard deviation is 0.8 hours.

   a. Please compute an approximate 99% confidence interval for the average sleep time of U.S. infants. (5 points)

$$14 \pm 3 * \frac{\sqrt{16} \times .8}{16} = 14 \pm .6 \quad \text{or}$$

$$14 \pm 2.6 * \frac{\sqrt{16} \times 8}{16} = 14 \pm .52$$

   The next 4 questions are worth 2 points each:

   b. The population for this study is (verbal answer) all infants

   c. The desired parameter being estimated by this study is (verbal answer) avg sleep time

   d. The sample for this study is size (numeric answer) 16

   e. The statistic calculated from the study is (numeric answer) 14 hrs.

   f. If you wanted your sample average to be within .25 hours (that is, 15 minutes) of the true population average with 99% confidence, how large should your sample size be? Please show your work. (10 points)

$$.25 = 3 * \frac{\sqrt{n} * .8}{n}$$

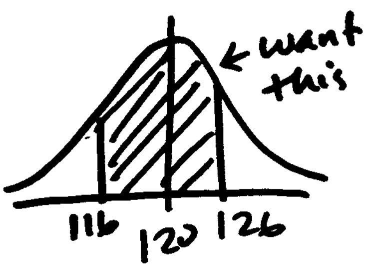
solve for $n \approx 92$

3. Exercise is particularly beneficial for young adults. A study wants examines the mean number of hours spent exercising per week by college students. Suppose it is known that 30% of all college students exercise weekly. A sample of 36 students is selected by a random process and it is found that a 99% confidence interval for the mean number of hours spent exercising by college students is 2.4 hours to 3.6 hours per week. Using this information, please answer the following true/false questions (4 points each)

	True	False	Statement
A		X	99% of all college students exercise between 2.4 and 3.6 hours per week.
B	X		There is a 99% chance that the interval 2.4 to 3.6 hours per week contains the mean hours spent exercising for all college students
C	X		If we quadrupled the sample size, we would expect the 99% confidence interval to be one half as wide.
D	X		If we decreased the confidence level to 68%, we would expect the confidence interval get narrower.
E	X		This 99% confidence interval can be valid when the population variable (hours spent exercising per week) is not normally distributed.
F		X	This 99% confidence interval is valid only when the sample information (hours spent exercising per week) is normally distributed
G	X		The purpose of this 99% confidence interval is to estimate the mean number of hours spent exercising per week by all college students.
H		X	There is a 99% chance that of the 36 students, the percentage of weekly exercisers will be between approximately 22.4% and 37.6%.

4. (use the information given in question 3 before the true-false questions) A physiology class needs more students for a valid study and a sample of size 36 is not enough. So if 400 college students are chosen at random instead of 36, what is the chance that between 116 and 126 of those chosen do indeed exercise weekly? (8 points)

expect 120 b/c 30% of 400 = 120



$$z_{126} = \frac{126-120}{\sqrt{400}*\sqrt{.3*.7}} \cong .65$$

$$z_{116} = \frac{116-120}{\sqrt{400}*\sqrt{.3*.7}} = -.45$$

$$\frac{48.43 + 34.73}{2} = 41.58\%$$

5. A professor made a careful sample survey to estimate the percentage of USC undergraduates living at home. Two assistants were stationed at the "Tommy" Trojan statue (it's on the main plaza) and instructed to interview all students who passed by at specified times. Many students would not speak with the assistants, in fact, only 309 out of 1000 approached, did. As it turned out, 27% of 309 students interviewed said they live at home. Does the investigator's procedure give a probability sample of USC students?

First, answer yes or no and then explain your reasons for your choice. This does not need to be a long answer. (7 points)

NO.

Selection bias
(justify)

and

Non Response bias
(justify)