1. Please indicate whether each statement is true or false (3 points each)

	True	False	Statement
1A		X	The Central Limit Theorem (CLT) suggests that an unbiased sample will be normally distributed if it is the result of a reasonably large number of draws from a population
1B	X		The mean of a probability histogram for percentages is expected to have the same value even when the number of random draws (random sample size) increases.
1C	X		The Central Limit Theorem (CLT) will apply in situations where the number of random draws (random sample size) is reasonably large and the population is normal.
1D		X	The variability of a probability histogram is described by its chance error.
1E		X	For a population that is not normally distributed, the distribution of sample percentages will have the same shape as the population when the sample (randomly drawn) is reasonably large.
1F	X		The Central Limit Theorem (CLT) implies that as the number of random draws (sample size) increases, the probability histogram for the sum appears increasingly normal.
1G	X		The probability histogram for unbiased random samples of reasonable size will be centered on the expected value for means (averages), sums and percentages.
1H	X		The Central Limit Theorem (CLT) implies than when it's conditions are met, a probability histogram can be correctly summarized by only an expected value and a standard error

2. (2 points each) Indicate whether each statement is true or false concerning the following 68% confidence interval that a student generated from a sample of size 144. Suppose the population was not normal and suppose the confidence interval was correctly calculated:

$$21\% \pm 1 * \left(\frac{\sqrt{144} * \sqrt{.21 * .79}}{144} * 100\right) = 21\% \pm 3.39\%$$

	True	False	
2A	X		Assume for this statement, the confidence interval was correctly calculated, then in 68% of all samples, the true population percentage would lie within Sample percentage ± Standard Error for a Percentage.
2B	X		The value $\sqrt{.21 * .79}$ is also called the standard deviation for a percentage
2C		X	Assume for this statement, the confidence interval was correctly calculated, 68% of the population would lie within: Sample percentage ± Standard Deviation for a Percentage
2D		X	Suppose the sample size were increased to 169, the width of the confidence interval would also increase
2E	X		Suppose the confidence level were increased from 68% to 90%, the width of the confidence interval would also increase

3. So you went to college, but your best friend in high school decided to skip college and work for an fast food chain called "Down and Out Burgers". After 2 years, you are accumulating a lot of bills but your best friend has now been promoted to manager and is earning $90,000 per year. You however know a lot about statistics and decide to pay your friend a visit, hoping to get a free burger perhaps. Your friend tells you that managing a restaurant is not an easy job. His "Down and Out Burgers" was designed to accommodate 6,000 customers per day. If the restaurant has approximately 6,000 customers it will earn $11,000 on that day. If instead there are 2,000 or fewer customers, the restaurant will lose $7,000 on that day. If there are 10,000 or more customers, it will lose $5,000 on that day. The history of the restaurant reveals that on 45% of the days the restaurant has approximately 6,000 customers and on 35% of the days it has 2,000 or fewer customers. You tell your friend that after you solve this problem you will be able to predict "Down and Out's" total income in a 121 day period (about 4 months). You should treat the 121 days as if they were random draws from a "box"

Please calculate the chance that your friend's "Down and Out" will experience no gain or a loss in a 121 day period (22 points)
(Show all of your work for full credit)

6,000	2000	10,000
$11,000	-7,000	-5,000
.45	.35	.2

10000/more → -$5000
6,000 → $11,000
2,000/fewer → -7,000

→ 121 days TOTAL

$$EV_{sum} = (121) \times [(.45)(11{,}000) + (.35)(-7{,}000) + (-5{,}000)(.2)]$$

$$121 \times [4950 + 2450 - 1000] = \$181{,}500$$

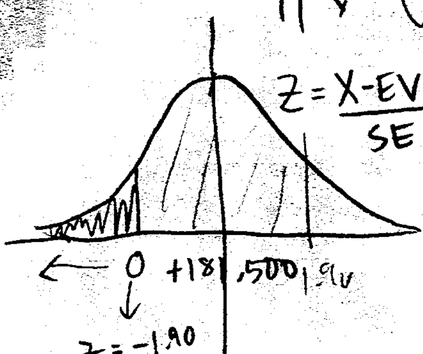
Box Avg = 1500

$$SE_{sum} = \sqrt{draws} \times \sqrt{(P_1)(a - \text{Box Avg})^2 + (P_2)(b - \text{box avg}^2) + (P_3)(c - \text{Box Avg})^2}$$

$$= \sqrt{121} \times \sqrt{(.45)(11{,}000-1500)^2 + (.35)(-7000-1500)^2 + (.2)(-5000-1500)^2}$$

$$11 \times \sqrt{40612500 + (25287500) + (8450000)}$$

$$11 \times \sqrt{7.435 \times 10^7} = 94849$$



$$Z = \frac{X - EV}{SE} \quad Z = \frac{0 - 181{,}500}{94849} \quad Z = -1.91356 \approx -1.90$$

$$\frac{100 - 94.26}{2} = \boxed{2.87\%}$$

no gain or a loss = 0

/22

4. The Super Bowl is the number one party event of the year for Americans, exceeding even New Year's Eve celebrations. Suppose it is known that the typical party has an average of 17 partygoers with a standard deviation of 3.3. On an ordinary Sunday afternoon, the average number of calories consumed in America is 600 but 36% will consume more than 2,000 calories. And only 5% will get drunk. Please assume that calories are normally distributed

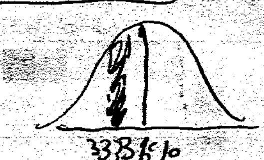
The Hardvard School of Public Health decided to study the effects of attending Super Bowl Sunday parties on the caloric consumption of Americans. 850 Americans were selected by random-digit dialing and interviewed by telephone. 490 Americans reported that they had attended a Super Bowl party, 110 did not attend a party but watched the Super Bowl on television at home. The remainder did not attend a Super Bowl party or watch the game. The calories consumed by the partygoers had a mean 1,330 with a standard deviation of 600. The calories consumed by the non-party goers had a mean of 560 with a standard deviation of 100. Among the party goers, 77% reported getting "drunk", among non-party goers who watched the game 15% reported getting "drunk" and only 7% of the non-party goers/non Bowl watchers reported getting "drunk" on Super Bowl Sunday. The average party had 19 partygoers. Please assume that all of the sample sizes are reasonably large and no biases exist.

A. What is the chance that a sample of size 850 will have between 33% and 35% of those surveyed consuming more than 2,000 calories? (5 points)

$$\boxed{\begin{matrix} \boxed{1} & \boxed{0} \\ .36 & .64 \end{matrix}}$$

$EV\% = 36\%$

$$SE\% = \frac{\sqrt{850} \times \sqrt{.36 \times .64}}{850} \times 100 = 1.65\%$$



$$z = \frac{33-36}{1.65} = -1.8 \approx 92.81$$

$$z = \frac{35-36}{1.65} = -0.6 \approx 45.15$$

$$\frac{92.81 - 45.15}{2} = \boxed{23.83\%}$$

B. Please construct an approximate 75% confidence interval for the population percentage of partygoers who reported getting "drunk". (4 points)

$EV\% \pm (1.15)\,SE$

$$\boxed{\begin{matrix} \boxed{1} & \boxed{0} \\ .77 & .23 \end{matrix}} \; 490$$

$EV\% = 0.77$

$$SE\% = \frac{\sqrt{490} \times \sqrt{.77 \times .23}}{490} \times 100 = 1.9\%$$

$77\% \pm (1.15)(1.9)$

$77\% \pm 2.185\%$

C. Can you construct an 80% confidence interval for the population percentage of non-party going/non-Super Bowl watching Americans who ~~got~~ drunk on Super Bowl Sunday? (circle one)

YES NO

If yes, please construct it in the space below, if no, please explain why this is not possible. (5 points)

$$\boxed{\begin{matrix} \boxed{1} & \boxed{0} \\ .07 & .93 \end{matrix}} \; 250$$

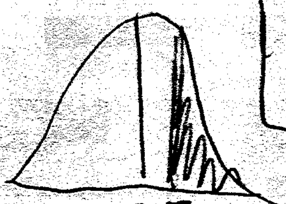
$EV\% = .07$

$$SE\% = \frac{\sqrt{250} \times \sqrt{.07 \times .93}}{250} \times 100 = 1.61$$

$7\% \pm (1.3)(1.61)$

$7\% \pm 2.1\%$

D. If 5% of all Americans are drunk on a typical Sunday afternoon, what is the chance that a simple random sample of 256 Americans will show that at least 7% are drunk on a typical Sunday afternoon? (5 points)



$$\boxed{\begin{matrix} \boxed{1} & \boxed{0} \\ .05 & .95 \end{matrix}} \; 256$$

$EV\% = 5\%$

$$SE\% = \frac{\sqrt{256} \times \sqrt{.05 \times .95}}{256} \times 100 = 1.36$$

$$z = \frac{7-5}{1.36} = 1.47 \approx 85.29\%$$

$$\frac{100 - 85.29}{2} = 7.355\%$$