

MAT 105 - Homework 9
Due Thursday, March 31, 2016, in class

1. Suppose X_1, X_2, \dots are independent random variables with mean $\mu = 2$ and variance $\sigma^2 = 1$. Let $S_{100} = X_1 + X_2 + \dots + X_{100}$.
 - (a) Use LLN to approximate S_{100} .
 - (b) Use CLT to find the probability $P(S_{100} \leq 225)$.
2. Roll a fair 6-sided die 80 times. Estimate the probability that the sum of all rolls exceeds 300.
3. An insurance company has 10,000 automobile policyholders. The expected yearly claim per policyholder is \$240 with a standard deviation of \$800. Estimate the probability that the TOTAL yearly claim exceeds \$2.7 million.
4. The time of the finishers in the New York City 10K run are normally distributed with a mean of 61 minutes and a standard deviation of 9 minutes. Find the probability that out of 100 runners, their average time is between 55 and 65 minutes. (Hint: Use S_{100} to be the sum of all their times and use CLT).
5. Suppose the checkout time at a grocery store has a mean of 5 minutes and standard deviation of 2 minutes. Estimate the probability that a checker will serve at least 49 customers during her 4-hour shift.
6. A researcher claims that 10% of football helmets have manufacturing flaws that could potentially cause injury. A sample of 200 helmets revealed 13 were defective. Approximate the probability that at most 13 helmets in the sample are defective. Does this finding support the researcher's claim?
7. A machine measures the bounce of 36 tennis balls and finds a mean of 1.7 ft and a standard deviation of 0.3 ft. What is the 95% confidence interval for the average bounce of tennis balls?
8. Of the first 10,000 votes cast in an election, 5,180 were for candidate A. Find a 95% confidence interval for the fraction of votes that candidate A will receive.
9. You poll 100 people on your game and count the number that give it thumbs up. You use this estimate to assess the probability that a randomly picked person will like your game.
 - (a) What is the 95% confidence interval for your result?
 - (b) What is the margin of error in your measurement?
10. You are taking a poll to forecast the outcome of an election. How many people do you have to poll so that with probability .95 your estimate will not differ from the true outcome by more than 2% (that is, the margin of error in the 95% confidence interval is at most 2%)?

EXTRA CREDIT: A certain component is critical to the operation of an electrical system and must be replaced immediately upon failure. If the lifetime of such component has mean 100 hours and standard deviation of 30 hours, how many components must be in stock so that the system is in continual operation for the next 2000 hours with probability of at least 95%?