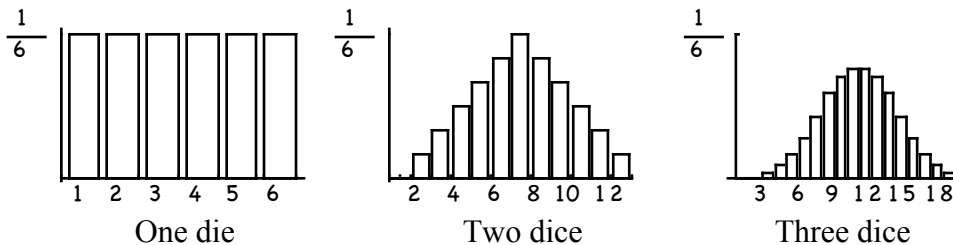


100 points possible. You may use R, a calculator, and any internet resources, but do not communicate with anyone during the test.

- (10 pts) 1. Roll one die. The probability distribution for its value is shown in the first picture. Roll two dice and take the sum, and you get the probability distribution in picture 2. Roll three dice and add them up, you get the probability distribution in picture 3.

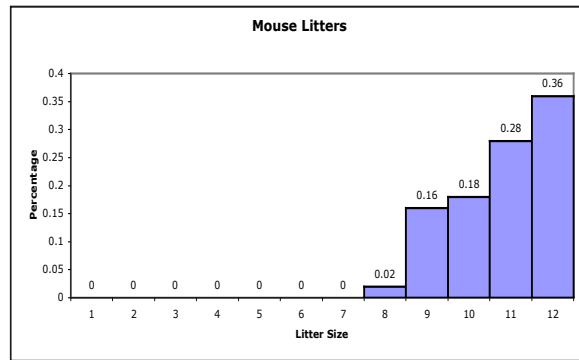


As you add more and more dice, what happens to the shape of the probability distribution of their sum? What theorem applies here?

- (10 pts) 2. A company receives a shipment of steel ball bearings machined to have diameter 5mm with standard deviation $\sigma = .0508$ mm.
- Sketch the sampling distribution for \bar{x} .
 - A SRS of 50 of the bearings gives a mean diameter $\bar{x} = 4.992$ mm. Is this significantly different from the advertised size of 5mm?
- (10 pts) 3. Scores on a skills test for electrical workers are normally distributed with mean 23 and standard deviation 8.5.
- Find the z -score corresponding to a test score of 30.
 - What percentage of electrical workers will score below 30?
- (10 pts) 4. Let x be a random variable that represents kg/day of milk produced by a certain breed of Brahman-Holstein cow. The x distribution is approximately normal with a mean $\mu = 11$ and standard deviation $\sigma = 2.5$.
- If a Venezuelan farmer has 40 such cows, what is his expected total milk production for one day?
 - What is the probability that his total milk production for one day is less than 400kg?
- (10 pts) 5. A local radio station wants to learn about its listeners. They call random local phone numbers until 100 people who listen to their station have responded to a survey.
- Is this an observational study or an experiment?
 - The 100 people are a sample. What is the implied population?
 - Give an example of a nominal variable that might be part of the data.
 - Give an example of a quantitative variable that might be part of the data.

- (10 pts) 7. A Santa Barbara, CA hospital released a study this February suggesting that chewing gum can help with recovery from surgery. The researchers studied 34 patients who underwent surgery to remove a portion of the large intestine - a procedure known as sigmoid colon resection. Half chewed sugarless gum three times a day following their surgery, the rest did not. The gum-chewing group left the hospital after an average of 4.3 days, compared with 6.8 days for the group that did not chew gum. TRUE or FALSE:
- This study was an observational study.
 - This study was double-blind.
 - This study had a control group.
 - 4.3 days is a statistic.
 - 34 patients is a parameter.

- (10 pts) 8. A study of about sixty mice found that mouse litter sizes followed the probability distribution shown.
- What is the probability that a mouse litter has less than 10 pinkies (baby mice)?
 - What is the probability that a mouse litter does not have 11 pinkies?



- (10 pts) 9. An assembly plant produces lawn mowers, and each mower has a serial number. Each day, the company takes 5 of the mowers and subjects them to heavy testing. For a day in which mowers were produced with serial numbers 160023 – 160599, how would you select the five mowers to ensure a simple random sample?

Write R code to select the mowers, and use it to choose five mowers.

- (10 pts) 10. Let x be a random variable representing the dive depth for elephant seals. From past studies of elephant seals, it is known that the standard deviation of x values is $\sigma = 90$ meters. For a newly tagged group of seals, how many dive depths should be recorded to be 95% confident that the sample mean dive depth \bar{x} is within 10 meters of the population mean dive depth?