

Homework Assignment 2 due Thursday 2/21

1. Probability calculations

(a) A fair coin is given 3 tosses. Calculate and plot the distribution of the number of heads. Repeat for 5 tosses. Repeat for 7 tosses. Can you describe the pattern generating the probabilities for n tosses.

(b) Birthday problem

A class has 30 people. What is the probability that two or more students share the same birthday?

2. Histograms

Someone has sketched one block of a family income histogram for a wealthy suburb. It is 1% per \$1,000 high, and flat (constant) between \$50,000 and \$100,000. About what percentage of families in the suburb had incomes between \$90,000 and \$100,000?

3. Averages

For registered students in US universities, which is larger: average age or median age?

4. SDs

A list has 10 numbers. Each number is either 1, 2 or 3.

(a) The average is 2 and the SD is 0. What is the list?

(b) The SD is 1. What is the list?

(c) Can the SD be bigger than 1?

5. Expected values, SD and covariance

The list is the same as in problem 4(b).

(a) Take a random draw from this list. What are the expected value and SD of this random variable?

- (b) 5 draws are made without replacement (SRS). What are the expected value and SD of the sample mean?
- (c) 5 draws are made with replacement. What are the expected value and SD of the sample mean?
- (d) What are the covariances between the first and second draws in (b) and (c)?

6. SAT scores

In a given year, math SAT scores averaged 500 with an SD of about 100. The histograms followed the normal curve pretty well. One of the people who took the test will be picked at random and you will be asked to guess his score. You will be given a dollar if you guess it right to within 50 points.

- (a) What should you guess?
- (b) What is your chance of winning?

7. In the survey of a statistics class of 314 students in UCB, an SRS sample (sampling without replacement) of 91 was drawn and 67 of 91 said they owned a PC. What is your estimate of the proportion of students owning a PC in the class? How would you describe the sampling variability in your estimate?
8. Suppose a survey of the 32,000 students at UCB is planned. The goal of the survey is to estimate the proportion of the students who own PC's. Find the minimum sample size required to make the SD of the sample mean at most 0.01. The variance of the population is known. Ignore the finite population correction factor.
- (a) In your calculation of the sample size, use the proportion of students who own PCs in the survey in problem 7 to estimate the population variance for the university students.
 - (b) Instead of using the proportion from the sample in your calculation, assume the worst-case scenario — that is, the largest variance possible for the population
9. The average age of the students in the survey in problem 7 was 19.5 years, and the sample standard deviation was 1.85 years. What is your estimate of average age of students in the class? How would you describe the sampling variability in your estimate?