

1. A university has 25000 students of whom 10000 are older than 25. The registrar draws a simple random sample of 400 voters.
 - (a) Find the expected value and standard error for the number of students in the sample who are older than 25.
 - (b) Find the expected value and standard error for the percentage of students in the sample who are older than 25.
 - (c) The percentage of students in the sample who are older than 25 will be around _____, give or take _____ or so.

2. Five hundred draws are made at random with replacement from a box with four tickets: three are labeled "0" and 1 is "1". True or false and explain.
 - (a) The number of 1's among the draws is exactly equal to the sum of the draws.
 - (b) The expected value for percentage of 1's among the draws is exactly equal to 25%.

3. A box with five tickets, labeled "0", "0", "0", "1", "2", has an average of 0.6 and a standard deviation of 0.8. What is the standard error for the percentage of "1"s in 400 draws?

4. Nine hundred draws are made at random with replacement from a box which has 1 red marble and 9 blue ones. The standard error for percentage of red marbles in the sample is 1%. If the sample percentage is within 1 standard error of the expected percentage, how large can it be?

5. You are drawing at random from a large box of red and blue marbles. Fill in the blanks.
 - (a) The expected value for the percentage of reds in the _____ equals the percentage of reds in the _____. Options: sample, population.
 - (b) As the number of draws goes up, the standard error for the _____ of reds in the sample goes up, but the standard error for the _____ of reds goes down. Options: number, percentage.

6. In a certain town, there are 30000 registered voters, of whom 12000 are Democrats. A survey organization is about to take a simple random sample of 1000 registered voters.
 - (a) The expected value for the percentage of Democrats in the sample is _____. The standard error for the percentage of Democrats in the sample is _____.
 - (b) The percentage of Democrats in the sample is likely to be around _____, give or take _____ or so.

- (c) Find the chance that between 39% and 41% of the registered voters in the sample are Democrats.
7. According to the Census, a certain town has a population of 100000 people age 18 and over. Of them, 60% are married, 10% have incomes over \$75000 a year, and 20% have college degrees. As part of a pre-election survey, a simple random sample of 1600 people will be drawn from this population.
- (a) To find the chance that 58% or less of the people in the sample are married, a box model is needed. Should the number of tickets in the box be 1600 or 100000? Explain. Then find the chance.
- (b) To find the chance that 11% or more of the people in the sample have incomes over \$75000 a year, a box model is needed. Should each ticket in the box show the person's income? Explain. Then find the chance.
- (c) Find the chance that between 19% and 21% of the people in the sample have a college degree.
8. One public opinion poll uses a simple random sample of size 1500 drawn from a town with a population of 25000. Another poll uses a simple random sample of size 1500 from a town with a population of 250000. The polls are trying to estimate the percentage of voters who favor single-payer health insurance. Other things being equal:
- (a) the first poll is likely to be quite a bit more accurate than the second.
- (b) the second poll is likely to be quite a bit more accurate than the first.
- (c) there is not likely to be much difference in accuracy between the two polls.
9. You have hired a polling organization to take a simple random sample from a box of 100000 tickets, and estimate the percentage of 1's in the box. Unknown to them, the box contains 50% 0's and 50% 1's. How far off should you expect them to be:
- (a) if they draw 2500 tickets?
- (b) if they draw 25000 tickets?
- (c) if they draw 100000 tickets?
10. A survey organization wants to take a simple random sample in order to estimate the percentage of people who have seen a certain television show. To keep their costs down, they want to take as small a sample as possible. But their client will only tolerate chance errors of 1 percentage point or so in the estimate. You may assume the population to be very large.
11. One hundred draws are made at random with replacement from each of the following boxes. The standard error for the percentage of 1's among the draws is smallest for box _____ and largest for box _____. Or is the standard error the same for all three boxes?

- (a) A box with two tickets: one labeled “1” and one labeled “0”.
 - (b) A box with twenty tickets: ten labeled “1” and ten labeled “0”.
 - (c) A box with two thousand tickets: one thousand labeled “1” and one thousand labeled “0”.
12. A box contains 2 red marbles and 8 blue ones. Four marbles are drawn at random. What is the standard error for the percentage of red marbles drawn when the draws are made with replacement? without replacement?
13. A die is rolled one thousand times. The percentage of aces should be _____ give or take _____ or so.
14. A group of 50000 tax forms has an average gross income of \$37000 with a standard deviation of \$20000. Furthermore, 20% of the forms have a gross income over \$50000. A group of 900 forms is chosen at random for audit. To estimate the chance that between 19% and 21% of the forms chosen for audit have gross incomes over \$50000, a box model is needed.
- (a) Should the number of tickets be 900 or 50000?
 - (b) Does each ticket in the box show a zero or a one or does each ticket show a gross income?
 - (c) True or false: the standard deviation of the box is \$20000.
 - (d) True or false: the number of the draws is 900.
 - (e) Find the chance (approximately) that between 19% and 21% of the forms chosen for audit have gross incomes over \$50000.
 - (f) With the information given, can you find the chance (approximately) that between 9% and 11% of the forms chosen for audit have gross incomes over \$75000? Either find the chance, or explain why you need more information.
15. Same as above exercise, except it is desired to find the chance (approximately) that the total gross income of the audited forms is over \$33000000. Work parts (a) through (d); then find the chance or explain why you need more information.