Sampling Distributions III

Lecture 18

02/27/2013

Turn on your clickers!

$X_1, X_2, \ldots, X_{50}$ are a simple random sample, with mean μ and standard deviation σ.

According to the CLT, what is the distribution of the sample mean $\bar{x}$?

(a) $\bar{x} \sim \mathcal{N}(0, 1)$

(b) $\bar{x} \sim \mathcal{N}(\mu, \sigma)$

(c) $\bar{x} \sim \mathcal{N}(\mu, \sigma/\sqrt{50})$

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$X_1, X_2, \ldots, X_{50}$ follow a Binomial distribution Bin(50,0.3)

According to the Normal Approximation to the Binomial, what is the distribution of the sample proportion $\hat{p}$?

(a) $\hat{p} \sim \mathcal{N}(0, 1)$

(b) $\hat{p} \sim \mathcal{N}(50(0.3), \sqrt{\frac{(0.7)(0.3)}{50}})$

(c) $\hat{p} \sim \mathcal{N}(50, \sqrt{(0.7)(0.3)}$

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It is known that 12% of all students taking a particular course receive a grade of A. There are 155 students in one section of the course.

Is the use of normal approximation justified in this case?

(a) yes, because $np > 10$ and $n(1-p) > 10$

(b) yes, because $np > 10$ and $np(1-p) > 10$

(c) no, because $np > 10$ and $np(1-p) > 10$

(d) no, because $np > 10$ and $n(1-p) > 10$

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Incomes in a certain town are strongly *right skewed* with mean \$36,000 and standard deviation \$7,000.

A random sample of 75 households is taken. What is the standard deviation of the sample mean?

(a) \$808.29

(b) \$93.33

(c) \$7,000

Example 1

The final exam for a history class contains 30 multiple-choice questions, each of which has 4 possible answers. We assume that the students answer completely at random. If a student answers correctly, she gets 1 point, otherwise 0 points.

1. Write down the pmf of a student's score.
2. This history class has 81 students.

   Compute (approximately) the probability that the *average score* on this midterm is above 8.

   What are the assumptions that you make?

Example 2

- As part of a promotion for a new type of cracker, free trial samples are offered to shoppers in a local supermarket.
- The probability that a shopper will buy a packet of crackers after tasting the free sample is 0.2.
- Different shoppers that buy a packet of the crackers can be regarded as *independent* trials.
- If $\hat{p}$ is the proportion of 100 shoppers that buy a packet of the crackers after tasting a free sample

  (a) What is (approximately) the distribution of $\hat{p}$?

  (b) What is the probability that less than 30% buy a packet after tasting a free sample?