

AP Statistics – 6.3C	Name:
Goal: Understand Sampling without replacement	Date:

I. Example 1: (page 394)

Hiring Discrimination

- Work this problem out and then you should be able to do the next problem on your own.

Population: 15 males and 10 females
 Samples: 3 males and 5 females
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Sampling w/o replacement: $8/25$ OR sample is 32% of the population

B = Success = Selected female
 I: SRS is 32%, and sampling w/o replacement
 N = # trials = 8
 S = $P(S) = 10/25 = 40\%$

Conclusion: THE BINOMIAL DISTRIBUTION ASSUMES INDEPENDENCE. IN THIS CASE WE ARE SAMPLING WITHOUT REPLACEMENT AND THE SAMPLE IS TOO LARGE AND DOES NOT SATISFY THE 10% CONDITION. THIS EXPLAINS WHY THE BINOMIAL PROBABILITY (.124) IS SO FAR OFF FROM THE CORRECT PROBABILITY (.106)

II. Example 2:

Dead Batteries

Almost everyone has one—a drawer that holds miscellaneous batteries of all sizes. Suppose that your drawer contains 8 AAA batteries but only 6 of them are good. You need to choose 4 for your graphing calculator. If you randomly select 4 batteries, what is the probability that all 4 of the batteries you choose will work?

Problem: Explain why the answer isn't $P(X=4) = \binom{4}{4} (0.75)^4 (0.25)^0 = 0.3164$.

The actual probability is 0.2143.

B SUCCESS = GOOD BATTERY FAILURE = BAD BATTERY
 I RANDOMLY SELECT 4 OF THE 8 BATTERIES
 NOT INDEPENDENT BECAUSE WE ARE SELECTING LESS THAN 10% OF THE POPULATION (in this case $8=N$)
 N FIXED TRIALS $n=4$
 S FIXED PROBABILITY OF SUCCESS $P(S) = 6/8 = .75$

* BECAUSE WE ARE SAMPLING 50% ($4/8$) OF THE POPULATION, IT IS NOT REASONABLY TO IGNORE THE LACK OF INDEPENDENCE AND USE THE BINOMIAL DISTRIBUTION. THIS IS WHY THE BINOMIAL PROBABILITY IS SO DIFFERENT FROM THE ACTUAL PROBABILITY

III. Definition: Explain the "10% condition" (pg 394)

* SAMPLING WITHOUT REPLACEMENT CONDITION MUST MEET THE "10% CONDITION".

* WHEN TAKING AN SRS, WE CAN USE A BINOMIAL DISTRIBUTION AS LONG AS THE SAMPLE IS LESS THAN 10% OF THE POPULATION.

$$n \leq \frac{1}{10} N$$

n = sample
 N = population

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II. **Example 2:** *Dead Batteries*

Almost everyone has one—a drawer that holds miscellaneous batteries of all sizes. Suppose that your drawer contains 8 AAA batteries but only 6 of them are good. You need to choose 4 for your graphing calculator. If you randomly select 4 batteries, what is the probability that all 4 of the batteries you choose will work?

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Solution:

- Since we are sampling without replacement, the selections of batteries aren't independent. We can ignore this problem if the sample we are selecting is less than 10% of the population.
- However, in this case we are sampling 50% of the population (4/8), so it is not reasonable to ignore the lack of independence and use the binomial distribution.
- This explains why the binomial probability is so different from the actual probability.

III. **Definition:** *Explain the “10% condition”*