MAT1372, Classwork15, Fall2025

5.1 Point Estimates and Sampling Variability

1. Point estimates. ____

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2. Error: sampling error and bias.

Sampling error: ____

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Bias: ____

3. Example of the variability of a point estimate.

Suppose the proportion of American adults who support the expansion of solar energy is $p = 0.88$, which is our parameter of interest. How does the sample proportion $\hat{p}$ behave when the true population proportion is 0.88 (which we are **Not** supposed to know)?

Here's how we might go about constructing such a *simulation*:

(1) There were about 250 million American adults in 2018. On 250 million cards, write "support" on 88% of them and "not" on 12% of them.

(2) Mix up the card and pull out 1000 cards to represent our sample of 1000 adults

(3) Compute the fraction of the sample that say "support".

(4) Repeat (2) and (3) many, many times.

250×10^6

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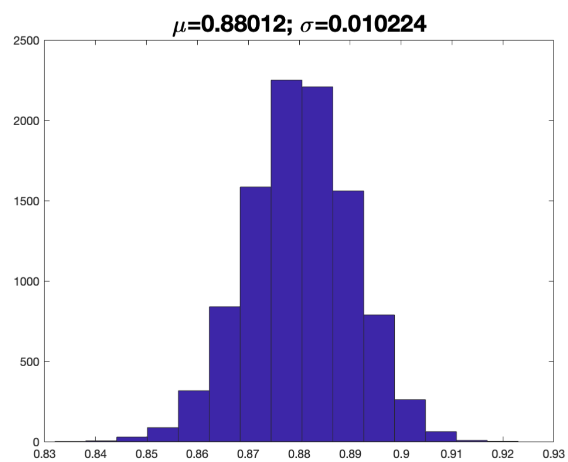
population = 250e6; n = 1e3; % sample size
num_simulation = 10000;%number of simulation
random_array = randperm(population);
mean_simulation =[];
for i=1: num_simulation
       x1=random_array(randi([1, population], n, 1));
       sample=[x1<=0.88*population*ones(size(x1))];
       mean = sum(sample)/n;
       mean_simulation =[mean_simulation mean];
end
hist(mean_simulation,30);
```



This code gives us a distribution of ____________ which is called a ____________:

Center. ____

____

Spread. ____

____

Shape. ____

4. **Central Limit Theorem** and **the Success-Failure Condition**

When observations are ______________________ and the sample size is ________________________________,

the sample proportion $\hat{p}$ will tend to follow a __________________________________with the following:

__________ $\mu_{\hat{p}} =$, and _______________________ $SE_{\hat{p}} =$

In order for the __________________________to hold, the _______________________ is typically considered __________________ when ___________________ and ____________________________, which is called the ____.

5. In 3., we estimated the mean and standard error of $\hat{p}$ using simulated data when p = 0.88 and n = 1000.

Confirm that the Central Limit Theorem applies and the sampling distribution is approximately normal.

Independence. ____

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Success-failure condition. ____

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6. Applying the Central Limit Theorem to a real-world setting.

In the real setting, we could _______ know what the _____________ proportion p is for supporting solar energy.

The thing we can do is a poll of 1000 people which gives us the ___________ proportion $\hat{p}$. Assume $\hat{p} = 0.887$.

Does the sample proportion from the poll approximately follow a normal distribution?

We can check the conditions from the ____.

Independence. ____

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Success-failure condition. ____

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7. Substitution Approximation of using $\hat{p}$. ____

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$$SE_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$$

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