DATA SCIENCE WITH R

Statistics Part 1 Review

1. **Two types of Statistics**
   - Descriptive
   - Inferential

2. **Random Variables**

3. **Probability Distributions – outcomes of random variables**
   - Discrete
   - Continuous

4. **Probability Distribution Functions**
   - Probability calculations using Tables – distances
   - Probability calculations using Formulae

DATA
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STATISTICS

★ Hypothesis Testing ★

DATA SCIENCE WITH R

HYPOTHESIS TESTING

→ Introduction to Hypothesis Testing

Basic Framework of a Hypothesis Test

Distance Measures

Central Limit Theorem

Types of Hypothesis Tests

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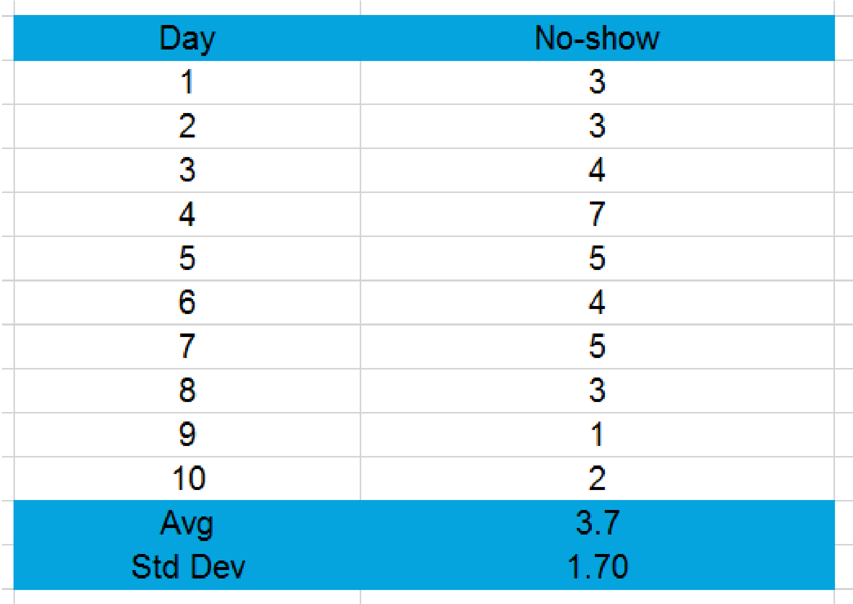

Day	No-show
1	3
2	3
3	4
4	7
5	5
6	4
7	5
8	3
9	1
10	2
Avg	3.7
Std Dev	1.70

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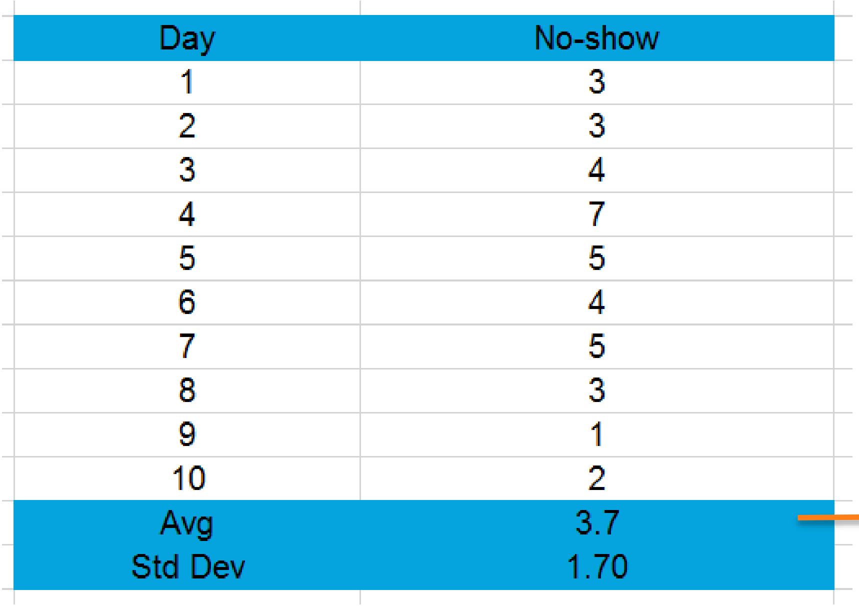

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→ **Not equal to 5%**

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No-shows is a random variable

With an expected value of 5 (per flight)

Two possible explanations for 3.7% -

1. Your sample is different from the population

2. There is no difference between sample and population – what you are seeing is simply random chance outcome!

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What options do you have next?

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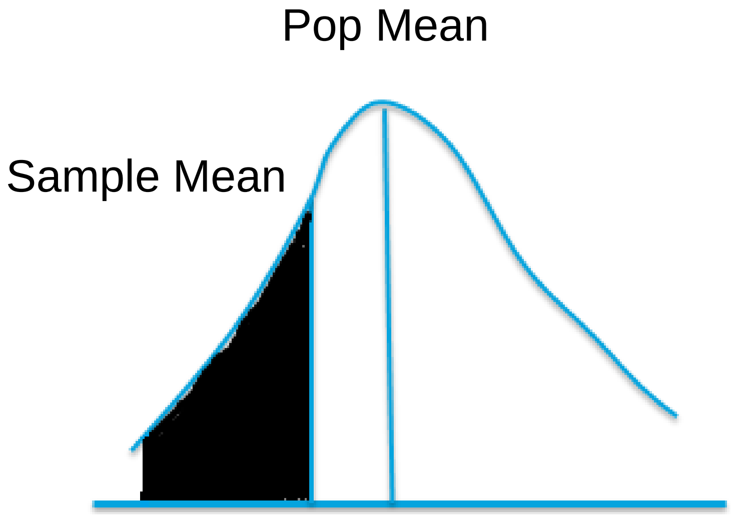

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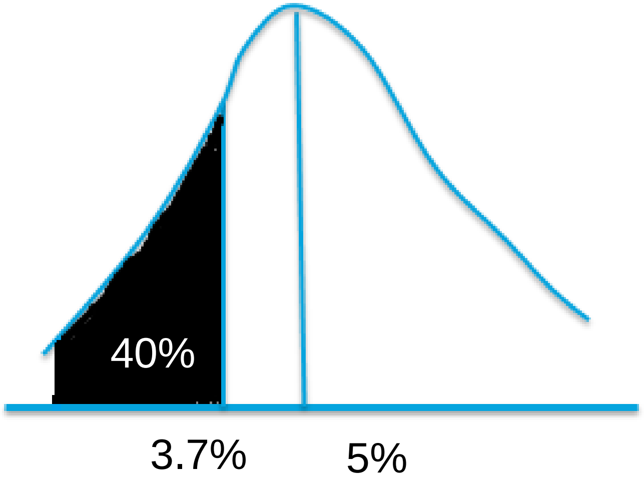
Let's say that we calculate this probability (of seeing a sample mean of 3.7% or less) and find it is 40%

What does that imply?



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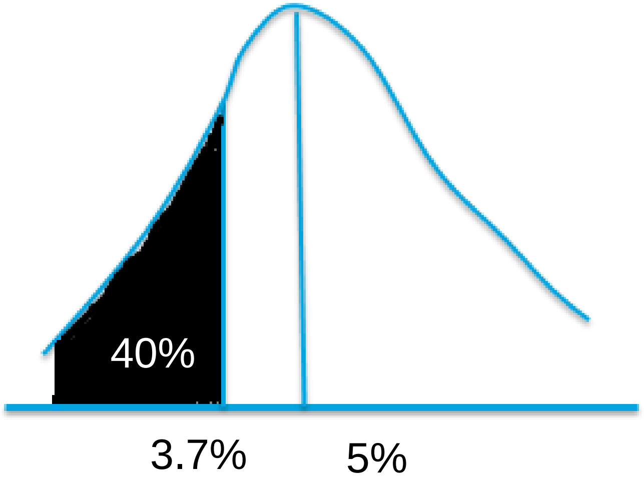
Let's say that we calculate this probability (of seeing a sample mean of 3.7% or less) and find it is 40%

What does that imply?

There is a 40% chance that when you pick a random sample from a population with a mean of 5%, you get a sample mean of 3.7% or lower

In other words, seeing a 3.7% or lower is pretty likely. You have very little reason to doubt that population average still applies, at 5%



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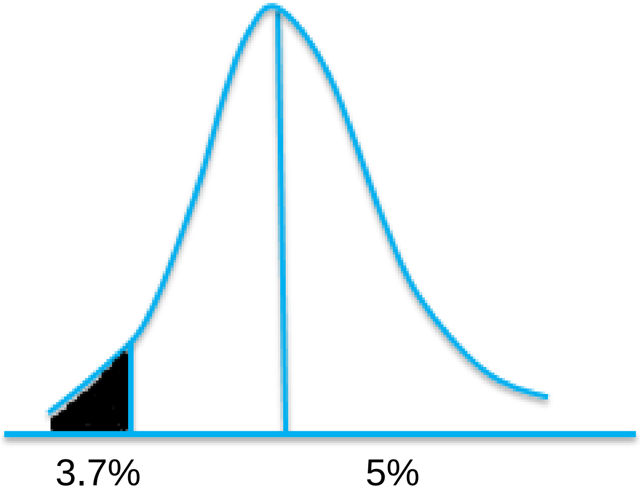
What is the probability of seeing 3.7% or less is not 40%, but lower, say 15%?

It implies that it is pretty unlikely that is the population mean was 5%, your sample mean would be 3.7% or lower simply because of random chance



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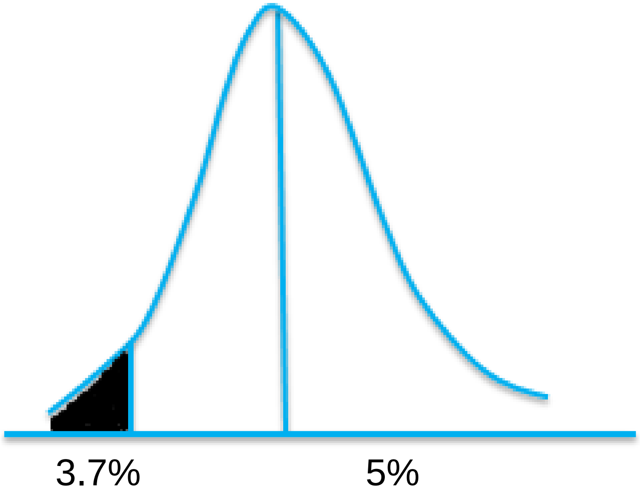
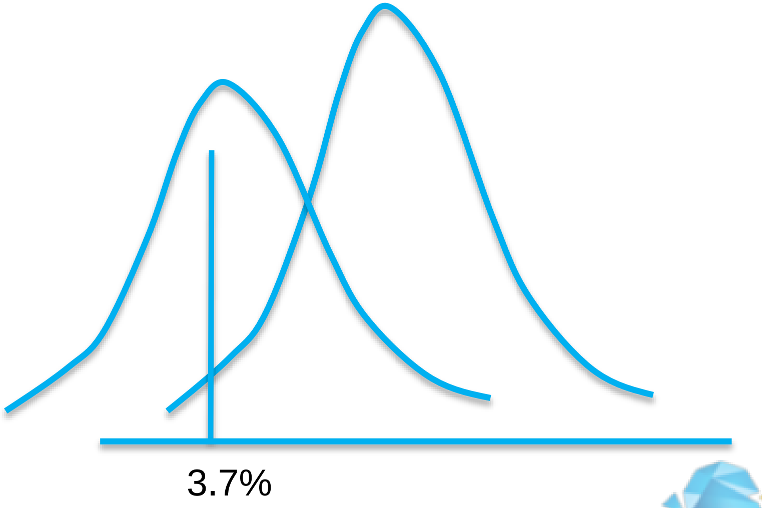


In other words, your sample is more likely to have come from a population with different (lower) mean than the one you are looking at -



Or, your sample is **different** from your population!

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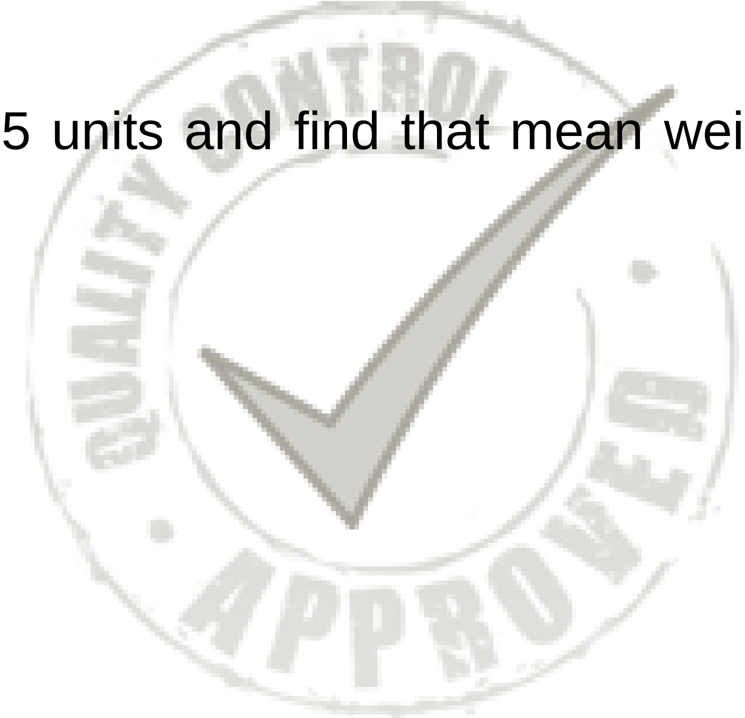
Is there an issue?



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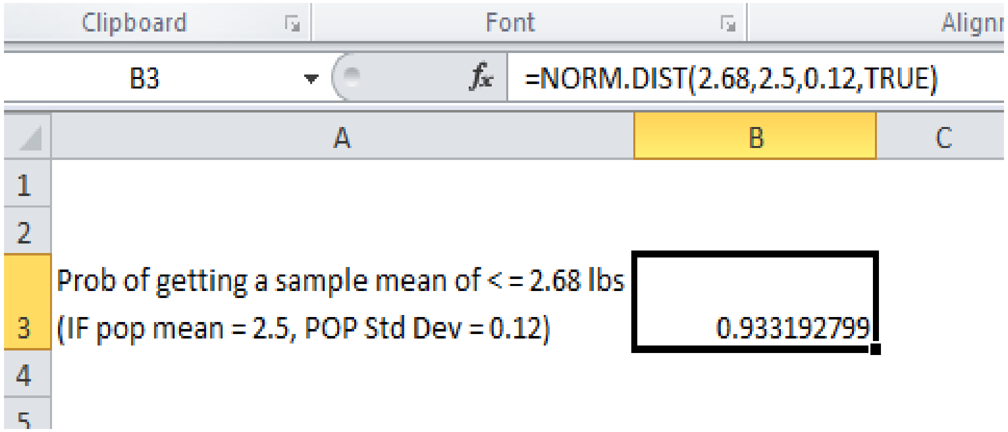
Calculate: Probability of seeing a sample mean of 2.68 if true population mean was 2.5



B3 =NORM.DIST(2.68,2.5,0.12,TRUE)

	A	B	C
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2			
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5			

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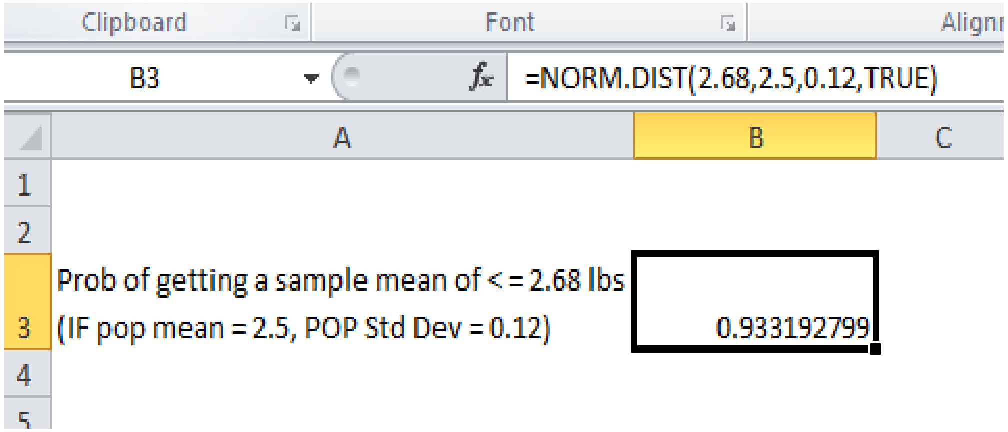

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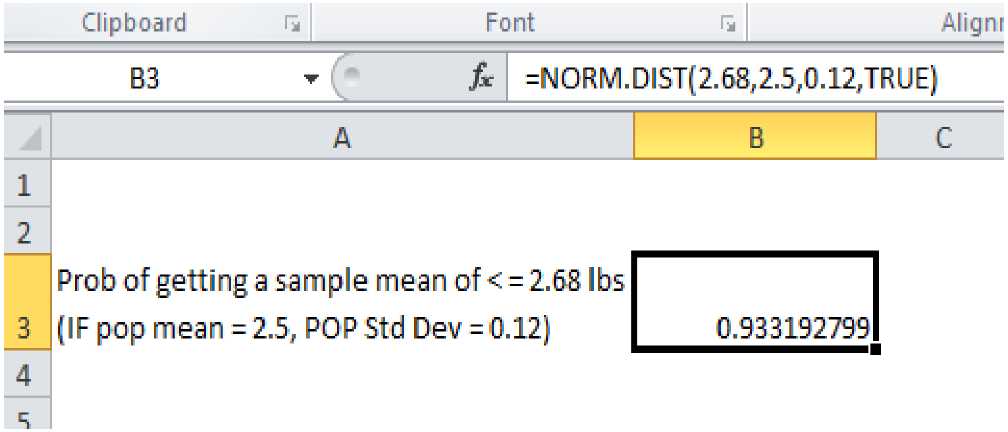

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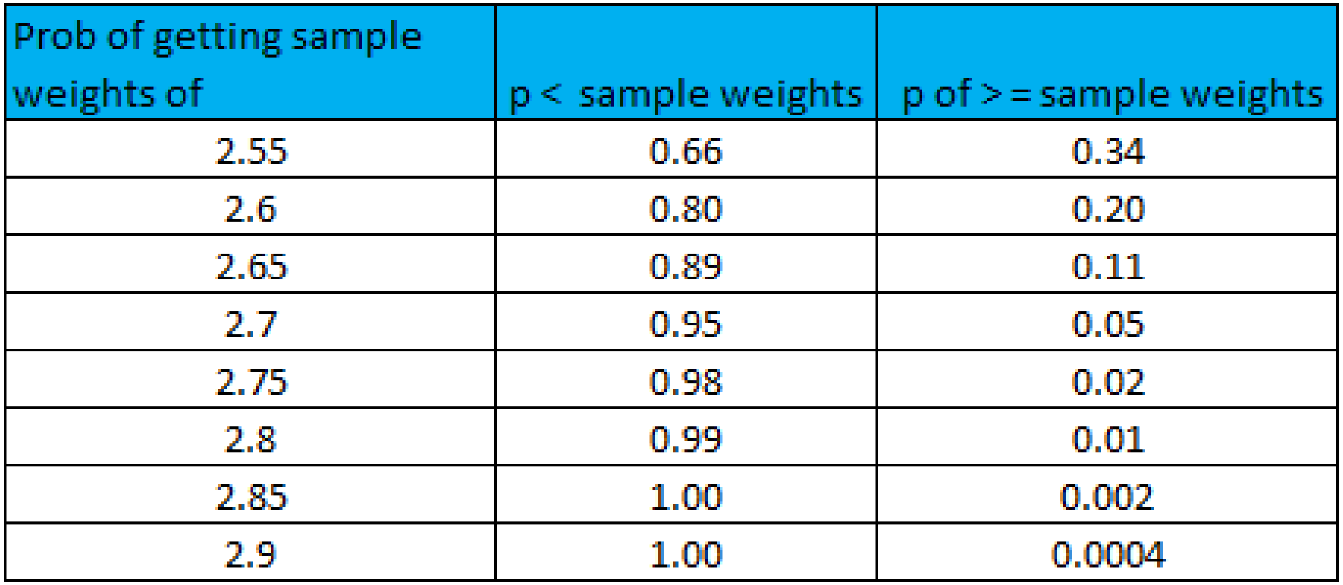
Prob of getting sample mean of 2.68 or higher = 0.07

Introduction

Conclusion?

There is a 7% chance that simply due to random chance your sample shows a mean weight of 2.68 lbs or greater, even if sample came from a population with a mean of 2.5 lbs



Prob of getting sample weights of	p < sample weights	p of > = sample weights
2.55	0.66	0.34
2.6	0.80	0.20
2.65	0.89	0.11
2.7	0.95	0.05
2.75	0.98	0.02
2.8	0.99	0.01
2.85	1.00	0.002
2.9	1.00	0.0004

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How would you choose between the two possible explanations?

Outcome	Probability	Conclusion
Random Chance of seeing different sample mean from population	High	Cannot conclude that there is a difference between sample and population
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But what would you consider high or low probability?

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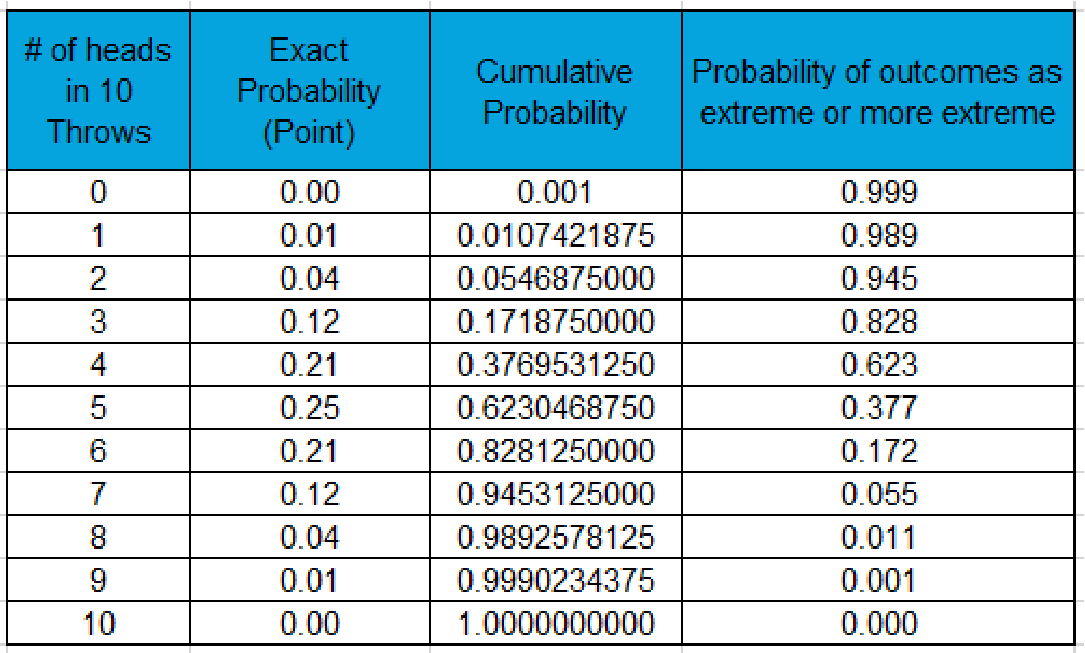

# of heads in 10 Throws	Exact Probability (Point)	Cumulative Probability	Probability of outcomes as extreme or more extreme
0	0.00	0.001	0.999
1	0.01	0.0107421875	0.989
2	0.04	0.0546875000	0.945
3	0.12	0.1718750000	0.828
4	0.21	0.3769531250	0.623
5	0.25	0.6230468750	0.377
6	0.21	0.8281250000	0.172
7	0.12	0.9453125000	0.055
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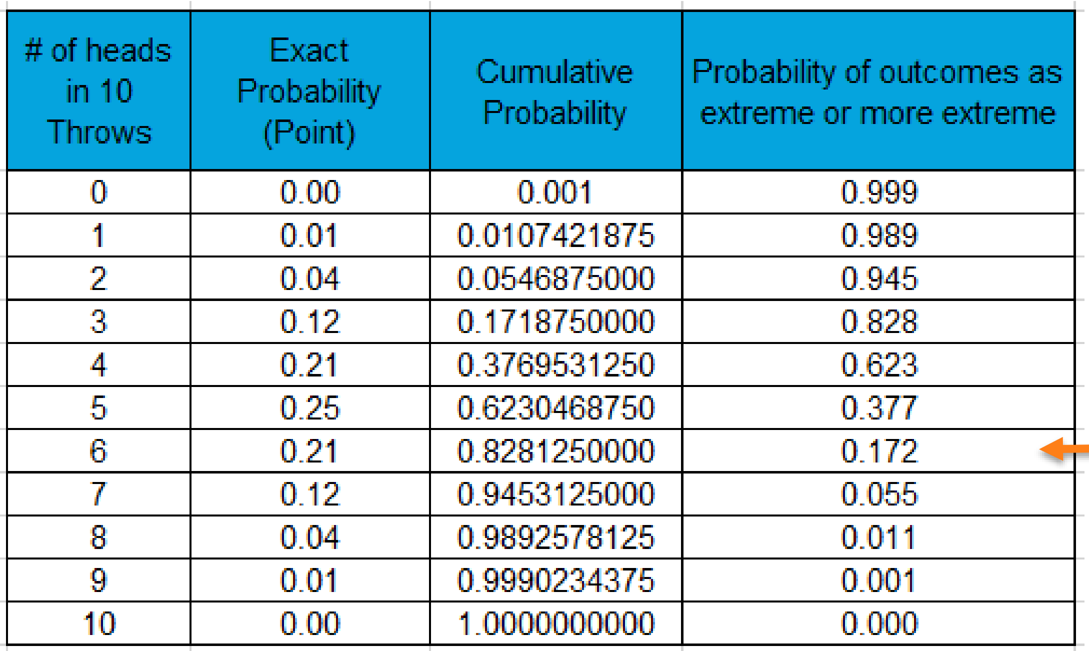

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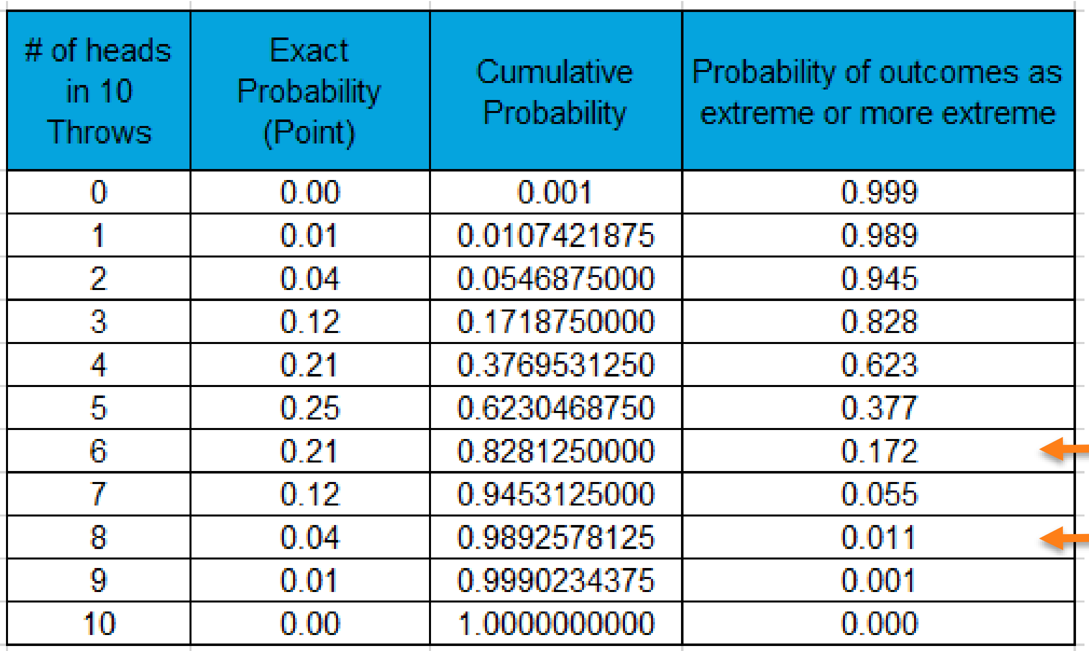

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Only if random chance probability of seeing sample means as extreme or more extreme than is observed is < 5%, will you conclude that sample is really different from the population

Is this a strong criteria or relaxed criteria?

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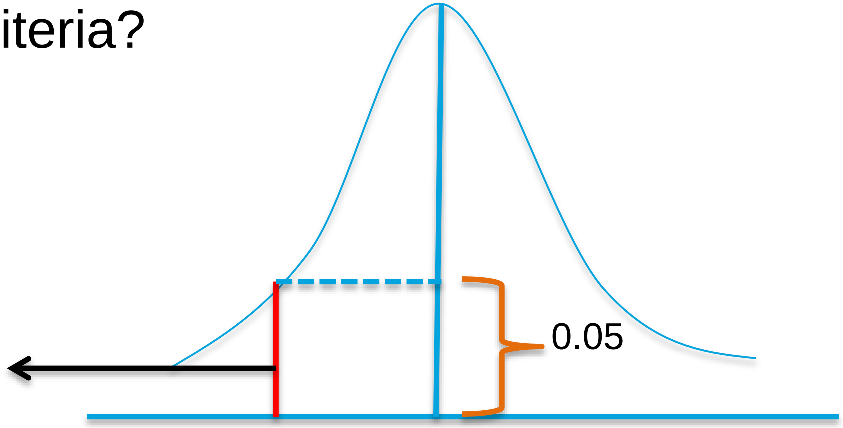
Conclude sample is different from population



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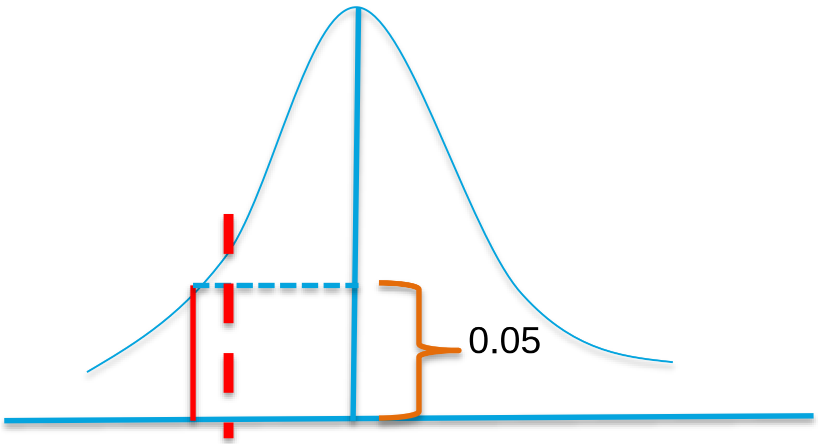

In the quality control example, we got a p-value of 0.07

What would that imply?

Recap

- Introduction to Hypothesis Tests

THANK YOU