Time Frame: 50 minutes

Subject Matter: Steps in Hypothesis Testing - Traditional Method TELL ME

Objective: TSWBAT understand the definitions and used in hypothesis testing and state the null and alternative hypotheses.

Standards: DA – 4.10

 Materials: PowerPoint Presentation, Calculator, and Worksheets

SHOW ME

Presentation of Information

The teacher will discuss the following:

* How much better is better?
	+ Suppose a school superintendent reads an article which states that the overall mean score for the SAT is 910. Furthermore, suppose that, for a sample of students, the average of the SAT scores in the superintendent’s school district is 960. Can the superintendent conclude that the students in his district scored higher than the average?
* There are two specific statistical tests used for hypotheses concerning means.
	+ *z* – test
	+ *t* – test

Definitions:

**Statistical hypothesis** – is a conjecture about a population parameter. This conjecture may or may not be true.

* There are two types of statistical hypotheses
	+ **Null hypothesis**, symbolized by $H\_{0}$ - is a statistical hypothesis which states that there is no significant difference between a parameter and specific value.
	+ **Alternative hypothesis,** symbolized by $H\_{1}$ - is a statistical hypothesis which states that the existence of a difference between a parameter and a specific value.

Examples:

**Situation A**

A medical researcher is interested in finding out whether a new medication will have any undesirable side effects. The researcher is particularly concerned with the pulse rate of the patients who take the medication. Will the pulse rate increase, decrease, or remain unchanged after a patient takes the medication? The mean pulse rate of the population is 82 beats per minute.

 $H\_{0}: μ=82$ and $H\_{1}: μ\ne 82$ (claim)

* The null hypothesis specifies that the mean will remain unchanged.
* The alternative hypothesis states that it will be different.
* This test is called ***two - tailed test***, since the possible side effects of the medicine could be to raise or lower the pulse rate.

**Situation B**

A chemist invents an additive to increase the life of an automobile battery. If the mean lifetime of an automobile battery is 36 months, then her hypotheses are

 $H\_{0}: μ\leq 36$ and $H\_{1}: μ>36$ (claim)

* In this situation, the chemist is interested only in increasing the lifetime of the batteries.
* So her alternative hypothesis is that the mean is greater than 36 months.
* The null hypothesis is that the mean is less than or equal to 36 months.
* This test is called ***right –tailed***, since the interest is in an increase only.

**Situation C**

A contractor wishes to lower the heating bills by using a special type of insulation in houses. If the average of the monthly heating bills is $78, her hypothesis about heating costs with the use of the insulation are

 $H\_{0}: μ\geq 82$ and $H\_{1}: μ<82$ (claim)

* In this situation, the contractor is interested only in lowering the heating costs.
* So her alternative hypothesis is that the mean is less than $78.
* The null hypothesis is that the mean is greater than or equal to $78.
* This test is called ***left – tailed,*** since the interest is in decrease only.

Exercises:

Classify the following common phrases as either $>, <, \geq , \leq , =, or \ne $.

1. Is above 11. Is greater than 21. Is shorter than
2. Is at least 12. Is not more than 22. Is above
3. Is less than 13. Is longer than 23. Is lower than
4. Is at most 14. Has not changed from 24. Is greater than or equal to
5. Is not more than 15. Is smaller than 25. Is less than or equal to
6. Is not equal to 16. Is below 26. Is the same as
7. Is exactly the same as 17. Is decreased or reduced from 27. Is different from
8. Has changed from 18. Is increased
9. Is higher than 19. Is equal to
10. Is not less than 20. Is bigger than

***Answers***

$>$$<$$\geq $

*Is greater than Is less than Is greater than or equal to*

*Is above Is below Is at least*

*Is higher than Is lower than Is not less than*

*Is longer than Is shorter than*

*Is bigger than Is smaller than*

*Is increased Is decreased or reduced from*

$\leq $$=$$\ne $

*Is less than or equal to Is equal to Is not equal to*

*Is at most Is exactly the same as Is different from*

*Is not more than Has not changed from Has changed from*

 *Is the same as Is not the same as*

Exercises:

State the null and alternative hypotheses for each conjecture.

1. A researcher thinks that if expectant mothers use vitamin pills, the birth weight of the babies will increase. The average weight of the population is 8.6 pounds.
2. An engineer hypothesizes that the mean number of defects can be decreased in a manufacturing process of compact disks by using robots instead of humans for certain tasks. The mean number of defective disks per 1000 is 18.
3. A psychologist feels that playing soft music during a test will change the results of the test. The psychologist is not sure whether the grades will be higher or lower. In the past, the mean of the score was 73.

*Answers*

1. $H\_{0}: μ\leq 8.6$ and $H\_{1}: μ>8.6$ (claim)  ***right-tailed***
2. $H\_{0}: μ\geq 82$ and $H\_{1}: μ<82$ (claim) ***left - tailed***
3. $H\_{0}: μ=73$ and $H\_{1}: μ\ne 73$ (claim) ***two – tailed***

Let Me Try

For each conjecture, state the null and alternative hypotheses. Identify whether the hypotheses are two – tailed, right – tailed, or left – tailed tests.

1. The average annual income of every household in a certain city is $45,250.
2. The average height of the NBA players is 6’5”.
3. The average salary of a Bachelor graduate is at least $3,450 per month.
4. The average number of text messages sent and received everyday is at most 1.5 million.
5. The average number of calories that a person burns by doing a 30 – minute jumping rope is not lower than 300 calories.
6. The average number of days that patients stay in a certain hospital is not more than 7.5 days.

Homework:

For each conjecture, state the null and alternative hypotheses.

1. The average age of the taxi drivers in New York City is 36.3 years.
2. The average income of nurses is $36,250.
3. The average age of disk jockeys is greater than 27.6 years.
4. The average pulse rate of female joggers is less than 72 beats per minute.
5. The average bowling score of people who enrolled in a basic bowling class is less than 100.
6. The average cost of a 3D-ready blu ray is $249.95.
7. The average electric bill for residents in Marlboro County exceeds $52.98 per month.
8. The average number of calories of brand A’s low-calorie meals is at most 300.
9. The average weight loss of people who use brand A’s low – calorie meals for 6 weeks is at least 3.6 pounds