CONCEPT: T-TEST

The t-test is used to test the _____ of two populations, one of which could be a standard.

- In order to test the similarities and differences between these two populations you can utilize the ***t-score***.

Use the t score formula when we don't know the population standard deviation and have a sample size less than _____.

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

_____ = sample average

_____ = population average

_____ = sample standard deviation

_____ = number of samples

- The larger the t-score then the more _____ the populations.
- The smaller the t-score then the more _____ the populations.

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t-calculated (for equal variance)

$$t_{Calculated} = \frac{\left|\bar{x}_1 - \bar{x}_2\right|}{s_{pooled}} \cdot \sqrt{\frac{n_1 n_2}{n_1 + n_2}} \qquad s_{pooled} = \sqrt{\frac{s_1^2(n_1 - 1) + s_2^2(n_2 - 1)}{n_1 + n_2 - 2}}$$

$$\text{Degrees of freedom} = n_1 + n_2 - 2$$

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t-calculated (for unequal variance)

$$t - calculated = \frac{\left|\bar{x}_1 - \bar{x}_2\right|}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \qquad \text{Degrees of freedom} = \left\{ \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}} \right\}$$

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t-calculated (paired data)

$$t_{Calculated} = \frac{\left|\bar{d}\right|}{s} \cdot \sqrt{n} \qquad s = \sqrt{\frac{\Sigma (d_i - \bar{d})^2}{n - 1}}$$

CONCEPT: T-TEST CALCULATIONS 1

EXAMPLE: A student wishing to calculate the amount of arsenic in cigarettes decides to run two separate methods in her analysis. The results (shown in ppm) are shown below:

Sample	**Method 1**	**Method 2**
1	110.5	104.7
2	93.1	95.8
3	63.0	71.2
4	72.3	69.9
5	121.6	118.7

Is there a significant difference between the two analytical methods under a 95% confidence interval?

CONCEPT: T-TEST CALCULATIONS 2

EXAMPLE: You want to determine if concentrations of hydrocarbons in seawater measured by fluorescence are significantly different than concentrations measured by a second method, specifically based on the use of gas chromatography/flame ionization detection (GC-FID). You measure the concentration of a certified standard reference material (100.0 µM) with both methods seven (n=7) times. Specifically, you first measure each sample by fluorescence, and then measure the same sample by GC-FID. The concentrations determined by the two methods are shown below.

[**fluorene (µM)**]

Sample	**Fluorescence**	**GC-FID**
1	100.2	101.1
2	100.9	100.5
3	99.9	100.2
4	100.1	100.2
5	100.1	99.8
6	101.1	100.7
7	100.0	99.9

Calculate the appropriate t-statistic to compare the two sets of measurements.

CONCEPT: T-TEST CALCULATIONS 3

EXAMPLE: A sample of size n = 100 produced the sample mean of 16. Assuming the population deviation is 3, compute a 95% confidence interval for the population mean.

PRACTICE: The average height of the US male is approximately 68 inches. What is the probability of selecting a group of males with average height of 72 inches or greater with a standard deviation of 5 inches?

z	.00	.01	.02	.03	.04	.05	.06	.07	0.8	0.9
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7589	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621