Statistics and Environmental Modelling

Bio CEP-621

FIRST STATISTICAL TEST

(one sample z-test/t-test)
(Part 2)

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A professor wants to know if her introductory statistics class has a good grasp of basic math. Six students are chosen at random from the class and given a math proficiency test. The professor wants the class to be able to score above 70 on the test. The six students get scores of 62, 92, 75, 68, 83, and 95. Can the professor have 90 percent confidence that the mean score for the class on the test would be above 70?

H_o: μ = 70 (mean score for the class = 70)

H_a: μ > 70 (mean score for the class >70)

$\mu = 70$

$n = 6$

$\alpha = 0.1$

62, 92, 75, 68, 83, 95

$df = 5$

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

$$\overline{X} = \frac{\Sigma x}{n}$$

$$\overline{X} = \frac{(62 + 92 + 75 + 68 + 83 + 95)}{6} = 79.167$$

$$s = \frac{\sum (x - \overline{x})^2}{n-1}$$

$$s = \frac{(62-79.167)+(92-79.167)+(75-79.167)+(68-79.167)+(83-79.167)+(95-79.167)}{5}$$

s = 13.167

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

$$t = \frac{79.167 - 70}{13.167/\sqrt{6}} = 1.71$$

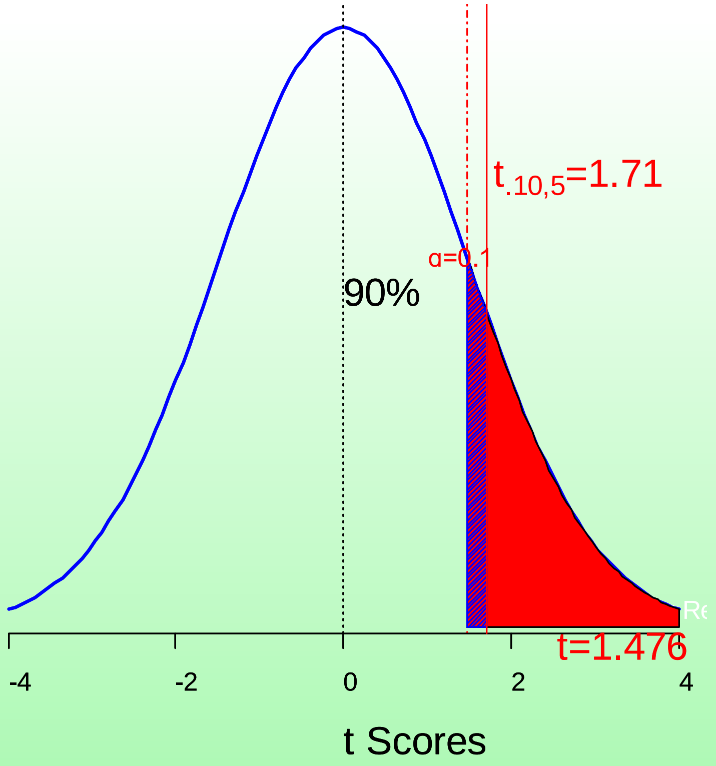
t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$
one-tail	**0.50**	**0.25**	**0.20**	**0.15**	**0.10**	**0.05**	**0.025**
two-tails	**1.00**	**0.50**	**0.40**	**0.30**	**0.20**	**0.10**	**0.05**
df							
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306

$1.476 < 1.71$

$(P < \alpha)$

- Accept/~~reject~~ H_0
- There is 90 percent confidence that the mean score for the class on the test would be above 70.



The average weight of fishes in a lake is 500 g. An survey on weight of 21 fishes was 532 g and standard deviation is 87. Is there enough evidence to suggest the average weight has differ.

H_o: μ = 500 (mean weight of fishes = 500 g)

H_a: μ ≠ 500 (mean weight of fishes ≠ 500 g)

$\mu = 500$

$n = 21$

$\bar{x} = 532$

$s = 87$

$\alpha = 0.05$

$df = 20$

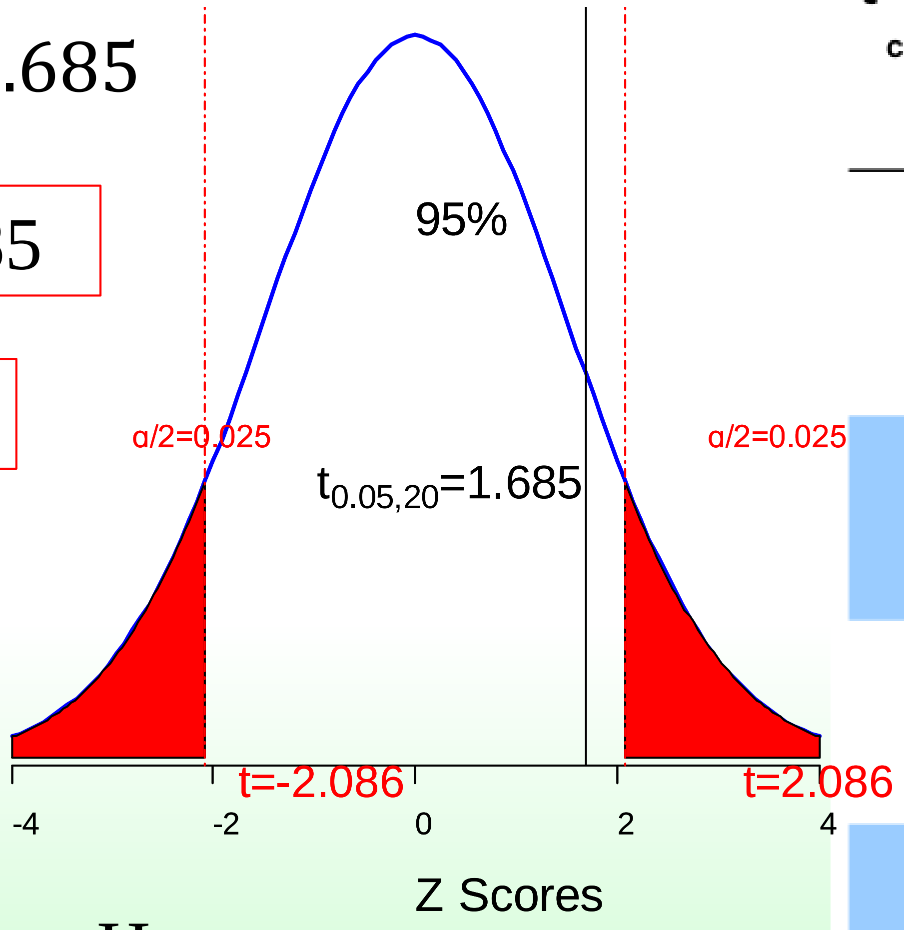
$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

$$t_{0.05,20} = \frac{532 - 500}{87/\sqrt{21}}$$

$$t_{0.05,20} = 1.685$$

2.086>1.685

(P > α)



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7	0.000	0.711	0.896	1.119	1.415	1.895	2.365
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086

- ~~Accept~~/reject H_0
- There is enough statistical evidence that the mean weights of fishes in the lake is equal to 500 g.

Summary

- population/sample variance
- normal/t distribution
- large/small sample
- one/two tail
- level of significance
- degrees of freedom

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1) For a one sample t-test with sample size 22, the degrees of freedom is

A. 23 **B.** 21 **C.** 22

2) If a 90% confidence interval is constructed to estimate μ, with n = 25, the correct critical value for t is

A. 1.645

B. 1.711

C. 2.064

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two-tails	**1.00**	**0.50**	**0.40**	**0.30**	**0.20**	**0.10**	**0.05**
df							
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960
	0%	50%	60%	70%	80%	90%	95%

Further reading

- Maurice A. G. 2018. Inferential Statistics and Probability. A Holistic Approach. De Anza College department of mathematics.

- Dharmaraja Selvamuthu and Dipayan Das. 2018. Introduction to Statistical Methods, Design of Experiments and Statistical Quality Control.