

## Answer on Question #70464, Math / Statistics and Probability

- (a) Test the hypothesis that the average dissolution time is 20 seconds, using the random sample of dissolution times below.  
Dissolution time (secs): 23 19 26 22 18 27
- (b) Two different instruments were used to make a number of replicate measurements. The results were:  
Instrument A: 12.06 12.14 12.03 12.09 12.05  
Instrument B: 14.62 14.97 14.60 14.51 14.01 14.11  
Do these results indicate that either instrument is more precise?

### Solution.

- (a) We face the challenge of verifying the hypothesis  $H_0: a = 20$  with an alternative hypothesis  $H_1: a \neq 20$ .

Hypothesis  $H_0$  is accepted if  $Z_{obs} \in (-z_{cr(\alpha, n-1)}, z_{cr(\alpha, n-1)})$ , where  $Z_{obs} = \frac{\bar{x} - 20}{s} \sqrt{n - 1}$ ,  $\bar{x}$  – sample mean,  $s$  – the square root of the variance corrected,  $n$  – sample size,  $z_{cr(\alpha, n-1)}$  – from a table of critical values of Student's distribution.

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i = \frac{1}{6} (23 + 19 + 26 + 22 + 18 + 27) = 22,5.$$
$$s^2 = \frac{1}{n - 1} \sum_{i=1}^n (x_i - \bar{x})^2 = 13,1; \quad s = 3,62.$$

So,

$$Z_{obs} = \frac{22,5 - 20}{3,62} \sqrt{6 - 1} = 1,54.$$

From the table of critical values of Student distribution at the level of significance  $\alpha = 0,05$  we find  $z_{cr(0,05,5)} = 2,57$ . Since  $|Z_{obs}| < z_{cr(0,05,5)}$ , the hypothesis  $H_0$  is accepted, that is, with the probability of 95% is confirmed the hypothesis that the average dissolution time is 20 seconds.

- (b) The instruments are equally accurate if the dispersion of their impressions is the same.  
Construct hypotheses:

$$H_0: \sigma_A^2 = \sigma_B^2;$$

$$H_1: \sigma_A^2 \neq \sigma_B^2.$$

Find the variances corrected (see the formula in (a)):  $s_A^2 = 0,002$ ,  $s_B^2 = 0,126$ .

According to Fisher's criterion  $F_{obs} = \frac{s_B^2}{s_A^2} = \frac{0,126}{0,002} = 63$ ,  $F_{cr} = F_{(0,05;5;4)} = 6,26$ . Since  $F_{obs} > F_{cr}$  then the hypothesis  $H_0$  reject, which means that the instruments are not exactly precise.

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