

Answer on Question #53739 – Math – Statistics and Probability

The Wechsler iq test is designed so that the mean is 100 and the standard deviation is 15 for the population of normal adults. Listed below are iq scores for professional pilots. It is claimed that because professional pilots are a more homogeneous group than the general population, they have iq with a standard deviation less than 15. Test the claim using a 0.5 significance level.

121 112 115 121 116 107 127 98 116 101 130 114

Solution

Let s be the standard deviation of IQ scores of professional pilots.

Null hypothesis H_0 : $s = 15$.

Alternative hypothesis H_a : $s < 15$ (“Professional pilots have IQ scores with a standard deviation less than 15”).

As the alternative hypothesis contains “ $<$ ” sign, the test is left-tailed. $\alpha = 0.5$.

| x_i | $x_i - \bar{x}$ | $(x_i - \bar{x})^2$ |
|-------|-----------------|---------------------|
| 121 | 6,17 | 38,0689 |
| 112 | -2,83 | 8,0089 |
| 115 | 0,17 | 0,0289 |
| 121 | 6,17 | 38,0689 |
| 116 | 1,17 | 1,3689 |
| 107 | -7,83 | 61,3089 |
| 127 | 12,17 | 148,1089 |
| 98 | -16,83 | 283,2489 |
| 116 | 1,17 | 1,3689 |
| 101 | -13,83 | 191,2689 |
| 130 | 15,17 | 230,1289 |
| 114 | -0,83 | 0,6889 |

Arithmetic mean $\bar{x} = \frac{\sum_{i=1}^{12} x_i}{12} = 114.83$.

The sample standard deviation: $s = \sqrt{\frac{\sum_{i=1}^{12} (x_i - \bar{x})^2}{12 - 1}} = 9.5$.

The test statistic is $\chi^2 = \frac{n-1}{\sigma^2} \cdot s^2 = \frac{12-1}{15^2} \cdot 9.5^2 = 4.412$.

For $\alpha = 0.5$ and $df = (12 - 1) * (2 - 1) = 11$ the critical value is 10.341 (determined by means of the table for chi-square distribution). As $4.412 < 10.341$, we should reject the null hypothesis, and we have enough evidence to support the claim that professional pilots have iq with a standard deviation less than 15.