Q1. A sample of eight earnings per share estimates for 1998 is shown below:

<table>
<thead>
<tr>
<th>Company</th>
<th>AT&amp;T</th>
<th>Caterpillar</th>
<th>Kodak</th>
<th>Exxon</th>
<th>hp</th>
<th>IBM</th>
<th>McDonalds</th>
<th>Wal-Mart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated</td>
<td>2.92</td>
<td>4.65</td>
<td>4.27</td>
<td>3.09</td>
<td>3.57</td>
<td>7.04</td>
<td>2.64</td>
<td>1.74</td>
</tr>
<tr>
<td>Earnings per Share</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on 10% significance level, do the data provide sufficient evidence to conclude that the standard deviation, in the earnings per share estimates, exceeds 1.5?

The hypotheses:  
\[ H_0: \sigma^2 \leq (1.5)^2 = 2.25 \quad \text{vs} \quad H_A: \sigma^2 > (1.5)^2 = 2.25 \]

The assumption: population is normally distributed.

The test statistic:
\[
\chi^2 = \frac{(n-1)S^2}{\sigma_0^2} = \frac{(8-1)(2.6490)^2}{2.25} = 8.1480
\]

The critical value:
\[ \chi^2_{0.10, 7} = 12.0170 \]

The decision rule & decision:
\[ \text{Reject } H_0 \text{ if } \chi^2 > \chi^2_{0.10, 7} \]
\[ 8.1480 \not\geq 12.0170 \]
\[ \text{Do NOT reject } H_0 \]

Conclusion:
Based on the sample data, there is no sufficient evidence to conclude that the standard deviation in the earnings per share estimates exceeds 1.5.
Q2. Media Matrix and Jupiter Communications gathered data on the time adults and the time teens spend online during a month. The study concluded that on average, adults spend more time online than teens. Assume that a follow-up study sampled 25 adults and 31 teens. The standard deviations of the time online during a month were 94 minutes for adults and 58 minutes for teens. Do the sample results support the conclusion that adults have greater variation in online time than teens? Use a 1% significance level.

<table>
<thead>
<tr>
<th>Adults $\rightarrow n_1$</th>
<th>Teens $\rightarrow n_2$</th>
</tr>
</thead>
</table>

The hypotheses: 
$H_0$: $\sigma_1^2 \leq \sigma_2^2$  \hspace{1cm} (\sigma_1^2 - \sigma_2^2 \leq 0)$  \hspace{1cm} $H_A$: $\sigma_1^2 > \sigma_2^2$  \hspace{1cm} ($\sigma_1^2 - \sigma_2^2 > 0$)  \hspace{1cm} (2) pt's

The assumptions: 
1. The two populations are normally distributed.  
2. The two sample variances are independent.  \hspace{1cm} (2) pt's

The test statistic:

$$F_c = \frac{S_1^2}{S_2^2} = \frac{(94)^2}{(58)^2}$$  \hspace{1cm} \{ (2) pt's \}

$$= \frac{8836}{3364}$$  \hspace{1cm} = 2.6266

The critical value:

$$F_{x, n_1-1, n_2-1} = F_{0.01, 24, 30} = 2.469 \hspace{1cm} (\text{2)} pt's$$

The decision rule & decision:

$$\text{Reject } H_0 \text{ if } F_c > F_{x, n_1-1, n_2-1}$$  \hspace{1cm} \{ (\text{2)} pt's \}

$$2.6266 > 2.469 \hspace{1cm} \checkmark$$

$$\therefore \text{Reject } H_0$$

Conclusion:

Based on the sample data, adults have greater variation in online time than teens.
Q3. Consumer panel preferences for three proposed displays follow:

<table>
<thead>
<tr>
<th>Display type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of preferences</td>
<td>43</td>
<td>53</td>
<td>39</td>
<td>135</td>
</tr>
</tbody>
</table>

Test that there are no differences in the preferences among the three types of displays, using a 2.5% level of significance.

The hypotheses:  
**H₀**: There are no differences among the three types of displays  
**Hₐ**: There are differences among the three types of displays

The assumption:  
\[ e_i \geq 5 \]  
\[ \sum e_i = 135 \]

The test statistic:
\[ \chi^2 = \sum_{i=1}^{k} \frac{(o_i - e_i)^2}{e_i} = \frac{(43-45)^2}{45} + \frac{(53-45)^2}{45} + \frac{(39-45)^2}{45} = 0.0889 + 1.4222 + 0.8000 = 2.3111 \]

The critical value:
\[ \chi^2_{\alpha, k-1} = \chi^2_{0.025, 2} = 7.3778 \]

The decision rule & decision:
\[ \text{Reject } H₀ \text{ if } \chi^2 > \chi^2_{\alpha, k-1} \]
\[ 2.3111 < 7.3778 \]

Conclusion:

There are no differences among the three types of displays  

OR  
Types of displays are uniformly distributed.
Q4. A study of educational levels of voters and their political party affiliations yielded the following results.

<table>
<thead>
<tr>
<th>Party Affiliation</th>
<th>Less than High School</th>
<th>High School Degree</th>
<th>College Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Democratic</td>
<td>40 (20)</td>
<td>30 (32.5)</td>
<td>30 (32.5)</td>
</tr>
<tr>
<td>Republican</td>
<td>20 (30)</td>
<td>35 (32.5)</td>
<td>45 (32.5)</td>
</tr>
</tbody>
</table>

Using a 5% level of significance, do you think that the Educational Level and the Party Affiliation are not related to each other?

The hypotheses:  
- **H₀**: Educational Level and the Party Affiliation are independent.  
- **Hₐ**: Educational Level and the Party Affiliation are not independent.

The assumption:  
- $eij \geq 5$  
- $\sum eij > 5$  

The test statistic:

$$
\chi^2 = \sum \sum \frac{(oij - eij)^2}{eij}
$$

$$
= \frac{(40-30)^2}{30} + \frac{(30-32.5)^2}{32.5} + \frac{(30-37.5)^2}{37.5} + \frac{(20-30)^2}{30} + \frac{(35-32.5)^2}{32.5} + \frac{(45-32.5)^2}{32.5}
$$

$$
= 3.3333 + 0.1923 + 1.500 + 3.3333 + 0.1923 + 1.500
$$

$$
= 10.0512
$$

The critical value:

$$
\chi^2_{0.05, (r-1)(c-1)} = \chi^2_{0.05, (2-1)(3-1)} = \chi^2_{0.05, 2} = 5.9915
$$

The decision rule & decision:

- Reject $H₀$ if $\chi^2 > \chi^2_{0.05, (r-1)(c-1)}$
- $10.0512 > 5.9915 \implies \Box p^{+1}$

Conclusion:

The educational level and the party affiliation are NOT independent.

With Our Best Wishes