1A * Solutions *

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

Company	AT&T	Caterpillar	Kodak	Exxon	*hp*	IBM	McDonalds	Wal-Mart
Estimated Earnings per Share	2.92	4.65	4.27	3.09	3.57	7.04	2.64	1.74

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: $\sigma^2 \le (1.5)^2 = 2.25$ H_A: $\sigma^2 > (1.5)^2 = 2.25$	2 pts
The assumption: population is normally distributed.	1 pt
The test statistic: $\bar{x} = \frac{\sum x_i}{n} = \frac{29.92}{8} = 3.74$, $S^2 = \frac{\sum (x_i - \bar{x})^2}{n-1} = 2.6190$ (1) $\chi^2_c = \frac{(n-1)S^2}{\sigma_0^2} = \frac{(8-1)(2.6190)}{2.25} = 8.1480$ (2)	3 pts
The critical value: $\chi^2_{\alpha, n-1} = \chi^2_{.10, 7} = 12.0170$	1 pt
The decision rule & decision: Reject H_0 if $\chi^2_c > \chi^2_{\alpha, n-1}$ $8.1480 \not> 12.0170$ $\therefore$ Do NOT reject H_0	2 pts
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	1 pt

2A ∗ Solution ∗

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.

Adults $\rightarrow n_1$ Teens $\rightarrow n_2$

The hypotheses: H_0: $\sigma_1^2 \le \sigma_2^2$ $(\sigma_1^2 - \sigma_2^2 \le 0)$ H_A: $\sigma_1^2 > \sigma_2^2$ $(\sigma_1^2 - \sigma_2^2 > 0)$ 2 pts

The assumptions:
1. The two populations are normally distributed.
2. The two sample variances are independent.

2 pts

The test statistic:

$$F_c = \frac{S_1^2}{S_2^2} = \frac{(94)^2}{(58)^2} = \frac{8836}{3364} = 2.6266$$

2 pts

The critical value:

$$F_{\alpha, n_1-1, n_2-1} = F_{.01, 24, 30} = 2.469$$

1 pt

The decision rule & decision:

Reject H_0 if $F_c > F_{\alpha, n_1-1, n_2-1}$

$2.6266 > 2.549$ ✓

$\therefore$ Reject H_0

1 pt

Conclusion:

Based on the sample data, adults have grater variation in online time than teens.

1 pt

3A * Solutions *

Q3. Consumer panel preferences for three proposed displays follow:

Display type	A	B	C	Total
Number of preferences	43	53	39	135

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

OR: Types of displays are uniformly distributed HA: Not uniformly distributed

The hypotheses: H_0: There are no differences among the three types of displays H_A: There are differences among the three types of displays 2 pts

The assumption: $e_i \geq 5$ } 1 pt

The test statistic:

$$e_1 = \frac{135}{3} = 45 = e_2 = e_3 \rightarrow \text{2 pts}$$

$$\chi^2_c = \sum_{i=1}^{k} \frac{(o_i - e_i)^2}{e_i} = \frac{(43-45)^2}{45} + \frac{(53-45)^2}{45} + \frac{(39-45)^2}{45}$$

$$= 0.0889 + 1.4222 + 0.8000$$

$$= 2.3111$$

3 pts

The critical value:

$$\chi^2_{\alpha, k-1} = \chi^2_{.025, 2} = 7.3778 \quad \text{1 pt}$$

The decision rule & decision:

Reject H_0 if $\chi^2_c > \chi^2_{\alpha, k-1}$

$2.3111 \not> 7.3778$

$\therefore$ DO NOT reject H_0

2 pts

Conclusion:

There are no differences among the three types of displays 1 pt

OR Types of displays are uniformly distributed.

Q4. A study of educational levels of voters and their political party affiliations yielded the following results

	Educational Level			
Party Affiliation	**Less than High School**	**High School Degree**	**College Degree**	
Democratic	40 (30)	30 (32.5)	30 (37.5)	100
Republican	20 (30)	35 (32.5)	45 (37.5)	100
	60	65	75	$\boxed{200}$

3 pts for e_{ij}

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: H_0:	Educational Level and the Party Affiliation are independent.
H_A:	Educational Level and the Party Affiliation are not independent. 2 pts
The assumption:	$e_{ij} \geq 5$ 1 pt
The test statistic:	$\chi^2_c = \sum_{i=1}^{r}\sum_{j=1}^{c} \frac{(o_{ij}-e_{ij})^2}{e_{ij}}$ $= \frac{(40-30)^2}{30} + \frac{(30-32.5)^2}{32.5} + \frac{(30-37.5)^2}{37.5} + \frac{(20-30)^2}{30} + \frac{(35-32.5)^2}{32.5} + \frac{(45-37.5)^2}{37.5}$ $= 3.3333 + 0.1923 + 1.500 + 3.3333 + 0.1923 + 1.5000$ 3 pts $= 10.0512$.
The critical value:	$\chi^2_{\alpha,(r-1)(c-1)} = \chi^2_{.05,(2-1)(3-1)} = \chi^2_{.05,2} = 5.9915$ 1 pt
The decision rule & decision:	Reject Ho if $\chi^2_c > \chi^2_{\alpha,(r-1)(c-1)}$ $10.0512 > 5.9915$ ✓ $\therefore$ Reject Ho 2 pts
Conclusion:	The educational level and the party affiliation are NOT indep. 1 pt

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