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MAT 222
Spring 2019
Homework 7

"The sad truth is that most evil is done by people who never make up their minds to be good or evil"
–Hannah Arendt

Problem 1: Researchers are trying to determine if there is a relationship between video game players ranking (on a scale of 1, highest ranking, to 5, lowest ranking) and the difficult level they practice the game in (rated on a scale of 1, most difficult, to 5, least difficult). The data is summarized (partially) in the table below.

(a) Complete the table below:

Difficulty Level \Ranking	1	2	3	4	5	Total
1	15	5	*7*	0	0	27
2	2	*8*	*2*	1	0	*13*
3	1	1	0	2	0	*4*
4	1	0	0	4	*0*	5
5	*0*	*0*	1	3	9	13
Total	19	*14*	10	10	9	62

(b) Complete the table of expected values below:

Difficulty Level \Ranking	1	2	3	4	5
1	8.27	6.10	4.36	4.36	3.19
2	3.98	2.94	2.10	*2.10*	1.89
3	1.23	*0.90*	0.65	0.65	0.58
4	1.53	1.13	0.81	0.81	0.73
5	3.98	2.94	*2.10*	2.10	1.89

(c) Complete the table of χ^2-contributions below:

Difficulty Level \Ranking	1	2	3	4	5
1	5.47	0.20	1.61	4.35	3.92
2	0.99	8.73	*0.00*	0.57	1.89
3	0.04	0.01	0.64	*2.85*	0.58
4	0.18	1.13	0.81	12.65	0.73
5	*3.98*	2.94	0.57	0.39	26.81

[Turn to the back to complete the homework.]

(d) Give appropriate null and alternative hypotheses to test if there is a relationship between video game players ranking and the difficult level they practice the game in. Be sure to give your test statistic, degrees of freedom, p-value, and conclusions. [Use $\alpha = 0.01$.]

We have hypotheses

$$\begin{cases} H_0 : \textit{there is no association between ranking and difficulty level} \\ H_a : \textit{there is an association between ranking and difficulty level} \end{cases}$$

Summing the entries in the χ^2-contribution table, we find test statistic $X^2 = 82.04$. We have degrees of freedom $(5-1)(5-1) = 16$, so that we have p-value $p \approx 0$. Therefore, we reject the null hypothesis that there is no association between ranking and difficulty level.

(e) Should you believe the conclusions of your statistical analyses from (c)? Why or why not?

No. The assumption for a χ^2-test is that the average expected value is at least 5 and at least 1 expected count in each entry, which is certainly not the case for this test. Moreover, there are categories with no actual count.