4. A parent advisory board for a certain university was concerned about the effect of part-time jobs on the academic achievement of students attending the university. To obtain some information, the advisory board surveyed a simple random sample of 200 of the more than 20,000 students attending the university. Each student reported the average number of hours spent working part-time each week and his or her perception of the effect of part-time work on academic achievement. The data in the table below summarize the students' responses by average number of hours worked per week (less than 11, 11 to 20, more than 20) and perception of the effect of part-time work on academic achievement (positive, no effect, negative).

| | | Average Time Spent on Part-Time Jobs | | |
|---|---|---|---|---|
| | | Less Than 11 Hours per Week | 11 to 20 Hours per Week | More Than 20 Hours per Week |
| Perception of the Effect of Part-Time Work on Academic Achievement | Positive Effect | 21 | 9 | 5 |
| | No Effect | 58 | 32 | 15 |
| | Negative Effect | 18 | 23 | 19 |

A chi-square test was used to determine if there is an association between the effect of part-time work on academic achievement and the average number of hours per week that students work. Computer output that resulted from performing this test is shown below.

CHI-SQUARE TEST

Expected counts are printed below observed counts

| | <11 | 11–20 | >20 | Total |
|---|---|---|---|---|
| Positive | 21<br>16.975 | 9<br>11.200 | 5<br>6.825 | 35 |
| No effect | 58<br>50.925 | 32<br>33.600 | 15<br>20.475 | 105 |
| Negative | 18<br>29.100 | 23<br>19.200 | 19<br>11.700 | 60 |
| Total | 97 | 64 | 39 | 200 |

Chi-Sq = 13.938, DF = 4, P-Value = 0.007

(a) State the null and alternative hypotheses for this test.

(b) Discuss whether the conditions for a chi-square inference procedure are met for these data.

(c) Given the results from the chi-square test, what should the advisory board conclude?

(d) Based on your conclusion in part (c), which type of error (Type I or Type II) might the advisory board have made? Describe this error in the context of the question.