Name: Solutions

Math 130 Quiz 18

Date: 5/14/2025

1. (10 points) Are the teams that play in the World Series evenly matched? To win a World Series, a team must win 4 games. If the teams are evenly matched, we would expect the number of games played in the World Series to follow the distribution shown in the first 2 columns of the table below. The third column represents the actual number of games played in each World Series from 1930 to 2007. Does the data support the distribution that would exist if the teams were evenly matched? Use the $\alpha = 0.05$ level of significance. Use the p-value method.

Number of Games	Probability	Observed Frequency	E Expected Frequency
4	0.125	15	E=np=(77)(0.125)=9.625
5	0.25	15	E = np = (77)(0.25) = 19.05
6	0.3125	17	E = np = (77)(0,3/25) = 24.0000
7	0.3125	30	E=np = (77) (0.3125) = 24,0625

n = 77

Hyp. Test Ho: Py = 12.5 %, P5 = 25 %, P6=P7 = 31.35 % H1: Not all p's are as stated in Ho. Py = The probability that a world serves will take

exactly 4 games to complete

P7=

Test stat $\chi^2 = \sum \frac{(o-E)^2}{F}$ $= \frac{(15-9.625)^2}{9.625} + \dots + \frac{(30-24.0625)^2}{24.0625}^2$ =7.477922078

1

 $\frac{p - volue}{\alpha = 0.05} dF = k - 1 = 4 - 1 = 3$ $\frac{p - volue}{\alpha = 0.05} dF = k - 1 = 4 - 1 = 3$ $p - volue = P(2^{2} > 7.4779aa078)$ = 0.0581284502 $I_{5} p - volue = \alpha?$ 0.0581284502 < 0.05? T.4779aa078 $2^{-} 4779aa078$ $2^{-} 4779aa078$ $\frac{volue}{2} = \alpha$

Extra Credit (10 points) By the mid-1990s, Kristen Gilbert had been working for several years as a nurse at the Veteran's Administration Hospital in Northampton, Massachusetts. For a time, she had been one of the nurses that others most often looked up to. Lately, other nurses became increasingly suspicious that something was wrong. To them, if felt like more people were dying when Gilbert was working than when she wasn't and so they suspected that Gilbert may have played a part in the murder of these patients. An investigation was launched and data for 1641 random shifts at this hospital were collected and is summarized in the table below. Test the claim that a death occurring during a shift at this hospital is independent of whether or not Gilbert was working on that shift. Use the rejection region method. (Since this is a serious accusation, use a 0.01 significance level)

E's Death on Shift? Yes No 257 Gilbert 40 11.589 245.411 Yes 217 present? No 34 1350 1384 62.411 1321.589 1567 1641 74 Hyp. Test Rejection Region Ho! Death on a shift is independent of Gilbert's presence $\alpha = 0.01$ dP=(n-1)(0-1) = (2-1)(2-1) = (1)(1) = (H1: Death an a shift depends on 0.01 Gilbert's presence 6.635 Test stat Conclusion Reject Ho! $\chi^2 = \sum \frac{(o-E)^2}{E}$ Evidence suggests that a death on a shift depends on Gilberts $\frac{(40-11.589)^2}{11.589} + \cdots + \frac{(1350-1321.589)^2}{1321.589}$ presence. (86.48421433

Some formulas you may need:

$$E = pn$$
 $df = k - 1$ $\chi^{2} = \sum \frac{(O - E)^{2}}{E}$

$$\chi^{2} = \sum \frac{(O-E)^{2}}{E} \qquad E = \frac{(row \ total)(column \ total)}{grand \ total} \qquad df = (r-1)(c-1)$$