KEY

8/13/2009

STAT244 Intro to Probability and Statistics II
Quiz #5

There are three problems. Please do **exactly two** of them. If you try all three of them, let me know which to be graded. I would appreciate your cooperation.

1. Over the years, African-American actors in major cinema releases are more likely to have major roles in comedies than are white actors. The table shows the percentages of all roles by type of picture.

Type of Picture	Percentage of roles
Action and adventure	13.2
Comedy	31.9
Drama	23.0
Horror and suspense	12.5
Romantic comedy	8.2
Other	11.2

The next table shows the numbers of leading roles played by African-Americans in each type of film.

$n = 89$

Type of Picture	Number of roles	
Action and adventure	9	11.748
Comedy	40	28.391
Drama	17	20.470
Horror and suspense	11	11.125
Romantic comedy	5	7.298
Other	7	9.968
	O	E

Does the distribution of African-American roles differ from the overall distribution of roles? Use $\alpha = 0.05$. Hint: Figure out observed values and expected values, and then apply an appropriate formula.

a) Specify H_0 and H_1.

H_0: $p_1 = .132$, $p_2 = .319$, $p_3 = .23$, $p_4 = .125$, $p_5 = .082$, $p_6 = .112$

H_1: At least one of these is not true.

b) Compute the **p-value** to test your hypotheses.

$$\chi^2_{6-1} = \frac{(9-11.748)^2}{11.748} + \frac{(40-28.391)^2}{28.391} + \frac{(17-20.470)^2}{20.470} + \frac{(11-11.125)^2}{11.125}$$

$$+ \frac{(5-7.298)^2}{7.298} + \frac{(7-9.968)^2}{9.968} = 7.5866$$

p-value $= P(\chi^2_5 > 7.5866) \cdot > P(\chi^2_5 > 9.236) = .1 > \alpha = .05$.

Since p-value $> \alpha = .05$, we do not reject Ho.

That is, African-Americans play the same roles in each type of film.

2. A survey at a ballpark shows this selection of snacks purchased. At $\alpha = .1$, is the snack chosen independent of the gender of the consumer?

$98 * \frac{52}{98} * \frac{25}{98}$

Gender	Hot dog	Peanuts	Popcorn	Tot
Male	12 (13.265)	21 (15.388)	19 (23.347)	52
Female	13 (11.735)	8 (13.612)	25 (20.653)	46
Tot	25	29	44	98

Ho: The type of snack purchased is indep. of the gender of the consumer

H1: " dependent upon the gender of the consumer.

df $= (2-1)*(3-1) = 2$

$\alpha = .1$

$cv = \chi^2_{2,.1} = 4.605$

Test stat

$$= \frac{(12-13.265)^2}{13.265} + \frac{(21-15.388)^2}{15.388} + \cdots$$

$$+ \frac{(25-20.653)^2}{20.653} = 6.342$$

Since $\chi^2 = 6.342 > cv = 4.605$, we reject Ho.

That is, there is dependence between the type of snack chosen and the gender of the consumer.

3. According to a recent survey, 32% of Americans say that they are "very likely" to become organ donors. A researcher surveys 50 drivers in each of three neighborhoods to determine the percentage of those willing to donate their organs. The results are shown here. At $\alpha = .01$, test the claim that the proportions of those who will donate their organs are equal in all three neighborhoods.

$150 * \frac{50}{150} * \frac{63}{150} = 21$

	Neighborhood A	Neighborhood B	Neighborhood C	Tot
Will donate	28 (21)	14 (21)	21 (21)	63
Will not	22 (29)	36 (29)	29 (29)	87
Total	50	50	50	n=150

$H_0: P_A = P_B = P_C$.

H_1: At least one proportion is different.

$\alpha = .01$, $df = (2-1)*(3-1) = 2$

$CV = \chi^2_{2, .01} = 9.210$.

$$\chi^2_2 = \frac{(28-21)^2}{21} + \frac{(14-21)^2}{21} + \frac{(21-21)^2}{21} + \frac{(22-29)^2}{29} + \frac{(36-29)^2}{29} + \frac{(29-29)^2}{29} = 8.046$$

Since $\chi^2 = 8.046 < cv = 9.210$, we do not reject Ho.

That is, the proportions of those who will donate their organs are equal in all three neighborhoods.

Note that this $\alpha = .01$ is so small. A little larger value of α would lead to the rejection of Ho. One needs to be careful in selecting α.