CollegeBoard
Advanced Placement Program

AP® Statistics (Operational)
2004 Sample Student Responses

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5. A rural county hospital offers several health services. The hospital administrators conducted a poll to determine whether the residents' satisfaction with the available services depends on their gender. A random sample of 1,000 adult county residents was selected. The gender of each respondent was recorded and each was asked whether he or she was satisfied with the services offered by the hospital. The resulting data are shown in the table below.

	Male	Female	Total
Satisfied	384	416	800
Not Satisfied	80	120	200
Total	464	536	1,000

(a) Using a significance level of 0.05, conduct an appropriate test to determine if, for adult residents of this county, there is an association between gender and whether or not they were satisfied with services offered by the hospital.

H_0 : Gender and satisfaction of services are independent

H_a : Gender and satisfaction of services are dependent.

Assumptions: 1) The sample is random & we must assume independence.

2)

	M	F	Total
S	384	416	800
	(371.2)	(428.8)	
NS	80	120	200
NS	(92.8)	(107.2)	
	464	536	1000

All expected counts ≥ 5.

$Expected = \dfrac{(row)(column)}{(grand)}$

$\dfrac{(464)(800)}{1000} = 371.2$

$\dfrac{(536)(800)}{1000} = 428.8$

$\dfrac{(464)(200)}{1000} = 92.8$

$\dfrac{(536)(200)}{1000} = 107.2$

Procedure χ^2 test for independence

T.S. $\chi^2 = \sum \dfrac{(obs-exp)^2}{exp} = \dfrac{(384-371.2)^2}{371.2} + \dfrac{(416-428.8)^2}{428.8} + \dfrac{(80-92.8)^2}{92.8} + \dfrac{(120-107.2)^2}{107.2} = 4.117$

~~P=.0414~~
P=.0424

χ^2
4.117

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If you need more room for your work to part (a), use the space below.

Conclusion: Since $p \leq \alpha$, reject H_0! At the $\alpha = .05$ significance level, there is sufficient evidence to indicate that gender and satisfaction of services are not independent.

(b) Is $\frac{800}{1,000}$ a reasonable estimate for the proportion of all adult county residents who are satisfied with the services offered by this hospital? Explain why or why not.

This is a reasonable estimate for the proportion of all adult county residents who are satisfied w/ the services offered by the hospital because it is a random sample & we were not notified in the given data of any bias (measurement, selection, etc)

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5. A rural county hospital offers several health services. The hospital administrators conducted a poll to determine whether the residents' satisfaction with the available services depends on their gender. A random sample of 1,000 adult county residents was selected. The gender of each respondent was recorded and each was asked whether he or she was satisfied with the services offered by the hospital. The resulting data are shown in the table below.

	Male	Female	Total
Satisfied	384	416	800
Not Satisfied	80	120	200
Total	464	536	1,000

(a) Using a significance level of 0.05, conduct an appropriate test to determine if, for adult residents of this county, there is an association between gender and whether or not they were satisfied with services offered by the hospital.

χ^2 test

H_0: There is no association between gender and whether or not they were satisfied

H_a: There is an association between gender and whether or not they were satisfied

Assumption
All expected counts are greater than 5

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

$$\chi^2 = \frac{(384-371.2)^2}{371.2} + \frac{(416-428.8)^2}{428.8} + \frac{(80-92.8)^2}{92.8} + \frac{(120-107.2)^2}{107.2}$$

$\alpha = .05$ $\chi^2 = 4.1173 \Rightarrow p = .0424$ $df = 1$

We reject H_0. Therefore there is an association between gender and whether or not they were satisfied with services offered by the hospital.

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If you need more room for your work to part (a), use the space below.

(b) Is $\dfrac{800}{1,000}$ a reasonable estimate for the proportion of all adult county residents who are satisfied with the services offered by this hospital? Explain why or why not.

Yes it is a reasonable estimate because it was a random sample of that population. Also n=1000 is a large sample, so the resulting proportion is close to the true proportion.

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