1a) H_0: Distribution of mixed nuts is same as company claims

H_a: Distribution of mixed nuts is different than company claims

1b)

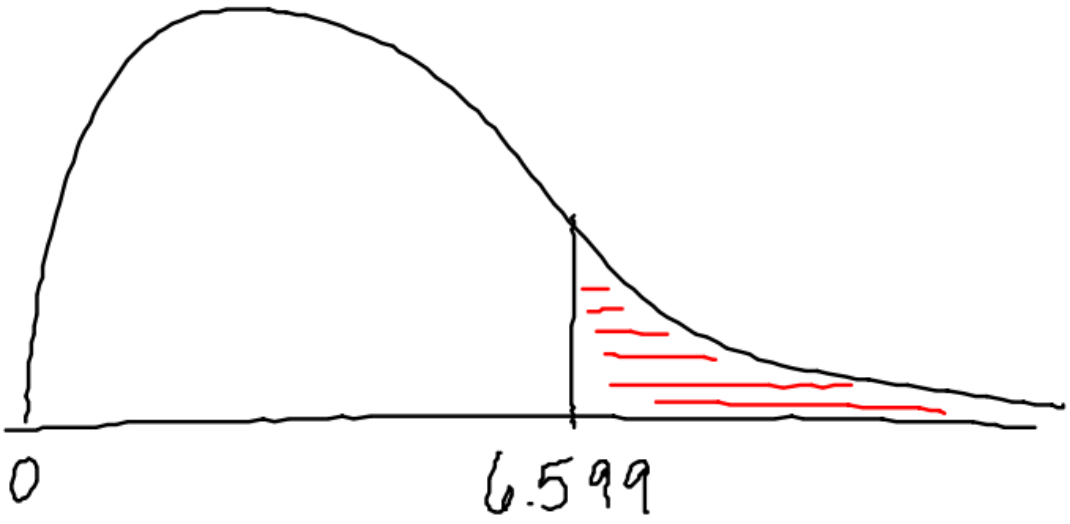
	Cash	Alm	Mac	Braz	
O	83	29	20	18	=150
E	78	40.5	19.5	12	

3) $$\chi^2 = \frac{(83-78)^2}{78} + \frac{(29-40.5)^2}{40.5} + \frac{(20-19.5)^2}{19.5} + \frac{(18-12)^2}{12} = 6.599$$

5a) All expected counts ≥ 5

$df = \#\text{categories} - 1 = 4 - 1 = 3$

5b)



5c) Table C → $.05 < p < .10$

$\chi^2 cdf(6.599, 100, 3) \rightarrow p = .0858$

5d) Fail to reject H_0; Company's claimed distribution accurate

2a) H_0: Distribution of outcomes on roulette wheel is same as advertised

Ha: Distribution of outcomes on roulette wheel is different as advertised

2b)

	Red	Black	Green
O	85	99	16
E	94.74	94.74	10.53

= 200

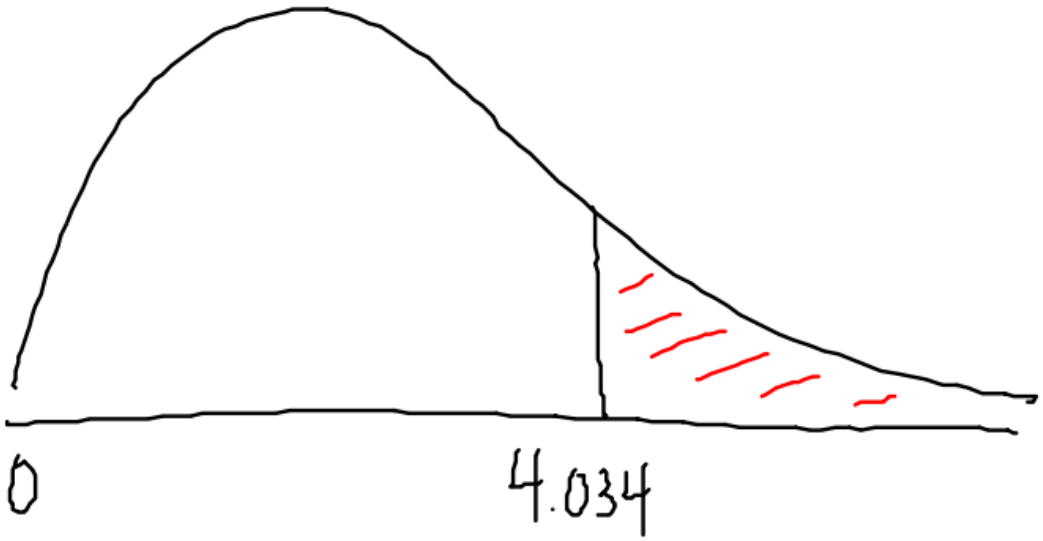
18 : 18 : 2 = 38 18/38

4) $$\chi^2 = \frac{(85-94.74)^2}{94.74} + \frac{(99-94.74)^2}{94.74} + \frac{(16-10.53)^2}{10.53} = 4.034$$

6a) All expected counts ≥ 5

Degrees of freedom $= 3 - 1 = 2$

b)



c) Table C → $.10 < p < .15$

$\chi^2 cdf(4.034, 100, 2) \rightarrow p = .1331$

d) Fail to reject H_0; distribution of outcomes on roulette wheel is same as advertised

12)

	His	Bl	W	Asian	Other
O	212	202	270	94	22
E	224	192	280	96	8

H) H_0: Distribution of race in a large housing complex is the same as the population of NYC

H_a: Distribution of race in a large housing complex is different than the population of NYC

A) Random Sample Used

All Expected Counts ≥ 5

$N > 10(800) > 8000$ residents in housing complex?

T) $$\chi^2 = \frac{(212-224)^2}{224} + \frac{(202-192)^2}{192}$$

$$+ \frac{(270-280)^2}{280} + \frac{(94-96)^2}{96}$$

$$+ \frac{(22-8)^2}{8} = 26.025$$

$df = 5-1 = 4$

Table C → $p < .0005$

$\chi^2 cdf(26, 100, 4) \rightarrow p = .00003$

5) Overwhelming evidence to reject H_0 and conclude the ethnic distribution of this housing complex is not the same as that of NYC as a whole

Follow Up:

$$\chi^2 = .64 + .52 + .36 + .04 + 24.5$$

Many more "others" lived in housing complex than we would have predicted

18)

	TC	TP	DC	DP
O	926	288	293	104
E	906.19	302.06	302.06	100.69

H) H_0: Distribution of potatoes is consistent with genetic laws

H_a: Distribution of potatoes is not consistent with genetic laws

A) Random ✓ Independent ✓

All expected counts ≥ 5

T)

$$\chi^2 = \frac{(926-906.19)^2}{906.19} + \frac{(288-302.06)^2}{302.06}$$

$$+ \frac{(293-302.06)^2}{302.06} + \frac{(104-100.69)^2}{100.69} = 1.469$$

$df = 4-1 = 3$

Table C $\rightarrow p > .25$

χ^2cdf $(1.469, 100, 3) \rightarrow p = .6894$

5) At $\alpha = .05$, we fail to reject H_0 and conclude the distribution of these potatoes is consistent with genetic laws

CHI-SQUARE TESTS
(Homogeneity of Populations)

1. Market researchers know that background music can influence the mood and purchasing behavior of customers. One study in a supermarket in Northern Ireland compared three treatments: no music, French accordion music and Italian string music. Under each condition, the researchers recorded the number of bottles of French, Italian and other wine purchased. The data is summarized in the 2-way data below:

	MUSIC			
WINE	None	French	Italian	
French	30	39	30 34	99
Italian	11 11	1	19	31
Other	43	35	35	113
	84	75	84	243

Do the data provide convincing evidence that music influences the purchasing behavior of customers? Carry out an appropriate test at the $\alpha = .05$ significance level.

Go On To The Next Page →

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Italian	11	11	1	16	19	11	31
Other	43	39	35	35	35	39	113
	84		75		84		243

Do the data provide convincing evidence that music influences the purchasing behavior of customers? Carry out an appropriate test at the $\alpha = .05$ significance level.

H Ho: Music has no influence on the purchasing behavior of customers

Ha: Music does have an influence on the purchasing behavior of customers

A Random ... unknown ... results may be invalid ☹
Expected counts ≥ 5 ... yes (see above)
Wine purchases independent

Go On To The Next Page →

T χ^2 Test For Homogeneity:

$\chi^2 = 18.28$ $(df = (3-1)(3-1) = 4)$

$p = .001$

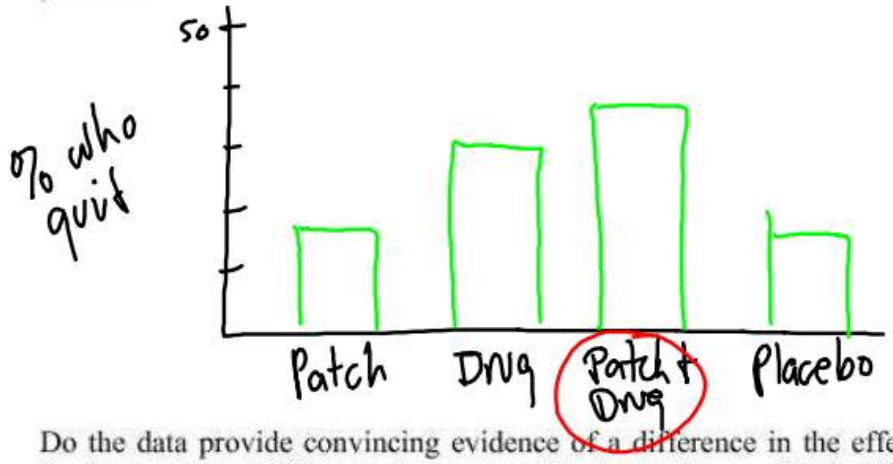
S At $\alpha = .05$, there is very good evidence that music influences wine purchases

2. A randomized, double-blind trial was conducted to determine how best to help smokers quit the habit. Below are the results of the study where a "success" means that the subject did not smoke for a year afterwards:

TREATMENT	SUCCESS		FAILURE	
Nicotine Patch	40	16%	204	= 244
Drug	74	30%	170	= 244
Patch plus Drug	87	36%	158	= 245
Placebo	25	16%	135	= 160

893

a. Make a graph to compare the success rates for the four treatments. Describe what you see.



b. Do the data provide convincing evidence of a difference in the effectiveness of the four treatments? Carry out an appropriate test at the $\alpha = .05$ significance level.

H Ho: There is no difference in the effectiveness of the 4 treatments

Ha: There is a difference in the effectiveness of the 4 treatments

A Randomized experiment

Expected Counts

62	182
62	182
62	183
40	120

≥ 5

Success rates are independent

T Chi Square Test For Homogeniety:

$\chi^2 = 34.98$ $(df = (4-1)(2-1) = 3)$

$p = .0000001$ (1.25×10^{-7})

S There is overwhelming evidence that there was a difference in the effectiveness of the 4 treatments

A random sample of 200 students was selected from a large college in the United States. Each selected student was asked to give his or her opinion about the following statement.

"The most important quality of a person who aspires to be the President of the United States is a knowledge of foreign affairs."

Each response was recorded in one of five categories. The gender of each selected student was noted. The data are summarized in the table below.

	Response Category					
	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	
Male	10 14	15 18	15 18	25 23	25 18	= 90
Female	20 17	25 22	25 22	25 25	15 22	= 110

Is there sufficient evidence to indicate that the response is dependent on gender? Provide statistical evidence to support your conclusion.

H) H_0: Gender and response are independent of each other

H_a: Response is dependent on gender

A) Random sample used

Expected counts ≥ 5 > See Above

Responses independent and

$N_M > 10(90) > 900$ $N_F > 10(110) > 1100$

4) χ^2-Test of Independence

$\chi^2 = 8.921$

$df = (2-1)(5-1) = 4$

$p = .063$

5) At $\alpha = .05$, we fail to reject H_0 and conclude that gender and response are independent of each other

2004 AP® STATISTICS FREE-RESPONSE QUESTIONS

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	384 321	416 429	800
Not Satisfied	80 93	120 107	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.

(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.

H) H_0: There is no association between gender and satisfaction

H_a: There is an association between gender and satisfaction

A) Random sample used

Expected counts ≥ 5 } See Above

Responses independent and

$N_M > 10(464) > 4640$ $N_F > 10(536) > 5360$

T) χ^2-Test of Association:

$$\chi^2 = 4.117$$

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

$$p = .042$$

S) There is evidence to reject H_0 and conclude that there <u>is</u> an association between gender and satisfaction

5b) Since $\frac{800}{1000}$ is a pooled proportion of everyone who is satisfied $\left(\frac{384+416}{464+536}\right)$ it is a reasonable estimate