2. | | | number in theatre |
|---|---|---|
| Freshmen | = 30% = 0.3 | 20 |
| Sophomores | = 25% = 0.25 | 22 |
| Juniors | = 25% = 0.25 | 22 |
| Seniors | = 20% = 0.2 | 15 |

$\alpha = 0.05$ $df = k - 1 = 3$

H_0: There is no difference between the student population and class status for theatre goers

	Pe	Po	(Pe − Po)	$(Pe - Po)^2$	$(Pe - Po)^2 / Pe$
Freshmen	0.3	0.25	0.05	2.5×10^{-2}	8.333×10^{-3}
Sophomores	0.25	0.2875	−0.0375	1.40625×10^{-2}	5.625×10^{-2}
Juniors	0.25	0.275	−0.025	6.25×10^{-4}	2.5×10^{-3}
Seniors	0.3	0.1875	0.1125	0.01269	0.04222
					$\sum = 0.05868 = \chi^2$

χ^2 being not equal to zero this suggests that the data distribution for the population and theater goers is different.

critical value at $df = (3, \alpha = 0.05) = 7.815$

$w = \sqrt{\chi^2} = \sqrt{0.05868} = 0.2422$ indicating a medium effect

4.

a) $P.e = 0.8$ $P.e = 0.2$

$P.o = \frac{33}{50} \times 100 = 0.66$ $pe = 0.34$.

	P.e	P.o	(P.o − Pe)	$(P.o - P.e)^2 / Pe$
> Age 25	0.8	0.66	0.14	0.0245
≤ 25	0.2	0.34	−0.14	0.098
				$\sum = 0.1225$

P value from this test shows that $\alpha > \alpha_{crit}$ therefore we reject the null hypothesis.

(b) $n = 50$

observed

	age > 25	age ≤ 25	
Parking tickets	33	17	= 50
no parking tickets	36	14	= 50
	69	31	= 100

Expected

	age < 25	age ≤ 25	Total
Parking tickets	34.5	15.5	50
No parking tickets	34.5	15.5	50
	69	31	100

$$\text{Expected} = \frac{\text{row total} \cdot \text{column total}}{\text{table total}}$$

$$\chi^2 = \frac{(O-E)^2}{E} = \frac{(33-34.5)^2}{33} + \frac{(17-15.5)^2}{17} + \frac{(36-34.5)^2}{36} + \frac{(14-15.5)^2}{14}$$

$df = (\text{no. groups} - 1) * (\text{no. g} \ldots) = 1 \times 1 = 1$

$\chi^2 = 0.4237$ $\chi^2_{crit} = 6.314$, $\chi^2 < \chi^2_{crit}$ therefore the sample is not different.

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6,

	P_e	P_o	$(P_e - P_o)$	$(P_e - P_o)^2 / P_e$
A_s	0.14	0.15	−0.01	7.143×10^{-4}
B_s	0.26	0.31	−0.05	9.616×10^{-3}
C_s	0.31	0.32	−0.01	3.226×10^{-4}
D_s	0.19	0.16	0.03	4.7368×10^{-3}
F_s	0.1	0.06	0.04	0.016
				$\Sigma = 0.0314$

Observed Proportions for A_s = 30/200 = 0.15
B_s = 62/200 = 0.31
C_s = 64/200 = 0.32
D_s = 32/200 = 0.16
F_s = 12/200 = 0.06

$df = 5 - 1 = 4$
$\alpha = 0.05$
χ^2 critical $\geq (4, 0.05) = 9.488$

$w = \sqrt{0.0314} = 0.1774$
This indicates a small effect.

Corresponding p-value to our obtained Chi-square = 0.949878
and therefore the result is not significant at $p < 0.05$

8, $n = 240$
It is assumed that there should be no preference and therefore
e (probability) = 1/3

	P_o	P_e	$P_o - P_e$	$(P_o - P_e)^2$	$(P_o - P_e)^2 / P_e$
design 1	0.45	0.333	0.117	0.013689	0.0411
design 2	0.31667	0.333	−0.01633	2.667×10^{-4}	8.009×10^{-4}
design 3	0.2233	0.333	−0.0997	9.9401×10^{-3}	0.02985
					$\Sigma = 0.07175$

a) The result indicate a diff because if there was no difference the Σ should have been zero.

b) cohen's w

$$w = \sqrt{\Sigma} = \sqrt{0.07175} = 0.2679$$

10.

	Observed Red	Yellow	Green	Blue		Expected Red	Yellow	Green	Blue
Introvert	10	3	15	22	50	25	5	10	10
Extrovert	90	17	25	18	150	75	15	30	30
	100	20	40	40	200				

To find the expected frequencies, we apply overall distribution of color preference to each sample.
Top row (50 introverts)

$$\text{Expected} = \frac{\text{Row total} \times \text{column total}}{\text{Table total}}$$

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O	e	(O-e)	$(O-e)^2$	$(O-e)^2/e$
10	25	-15	225	9
3	5	-2	4	0.8
15	10	5	25	2.5
22	10	12	144	14.4
90	75	15	225	3
17	15	2	4	3.75
25	30	-5	25	0.86
18	30	-12	144	4.8
				$\sum = 39.11 = \chi^2$

$\chi^2 = 39.11$

χ^2 critical $df = (\text{rows} - 1) * (\text{columns} - 1) = (4-1)(2-1) = 3$

$\alpha = 0.05$

$\chi^2_{\text{critical}}\ (3, 0.05) = 7.815$

The χ^2 is in the rejection region and we thus reject the null hypothesis and conclude that there is a significant relationship between the variables.

12.

observed:	completed	Not completed	Total
8 get 1	10	40	50
10 get 1	19	31	50
Total	29	71	100

Expected:	completed	Not completed	Total
8 get 1	14.5	35.50	50
10 get 1	14.5	35.50	50
	29	71	100

$$\text{Expected} = \frac{(\text{row totals} \cdot \text{colum totals})}{\text{Table total}}$$

O	e	(O-e)	$(O-e)^2$	$(O-e)^2/e$
10	14.5	-4.5	20.25	1.3966
40	35.50	4.5	20.25	0.5704
19	14.5	4.5	20.25	1.3966
31	35.50	-4.5	20.25	0.5704
				$\chi^2 = \sum = 3.934$

χ^2 critical, $\Rightarrow df = (2-1)(2-1) = 1$

$\alpha = 0.05$

$\chi^2_{\text{critical}} = 3.841$

χ^2 is in the critical region because $\chi^2 > \chi^2_{\text{critical}}$. The data therefore indicates a significant difference between the 2 card programs.

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14. observed :

	Owns a computer	Does not own a computer	Total
Age 18-30	378	336	714
Age 71>	23	127	150
Total	401	463	864

Expected = $\frac{\text{Grand total} \times \text{column total}}{\text{Table total}}$

Expected

	owns a comp	Does not own a comp	Total
Age 18-30	331.4	382.6	714
Age 71>	69.6	80.4	150
Total	401	463	864

O	e	(O-e)	$(O-e)^2/e$
378	331.4	46.6	6.553
336	382.6	-46.6	5.676
23	69.6	-46.6	31.201
127	80.4	46.6	27.009

$\chi^2 = \sum = 70.439$

$df = (r-1) \times (c-1) = 1$

$\alpha = 0.05$

$\chi_{crit} = 3.841$

a) Because $\chi_{crit} < \chi^2$ we conclude that the proportion of computer owners differs significantly from group to group

P.O	P.e	(P.O - P.e)	$(P.O - P.e)^2/Pe.$
0.5294	0.4641	0.0653	9.188×10^{-3}
0.4706	0.5359	-0.0653	7.957×10^{-3}
0.1533	0.464	-0.3107	0.2080
0.8466	0.536	0.3106	0.1800

$\sum = 0.4051$

Cohen's $w = \sqrt{\sum (P.O - Pe)^2/Pe}$

$w = \sqrt{0.4051} = 0.6364$

According to this cohen's w, the proportions differ by a great effect.

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16. Observed:

	No	yes	Total
not allowed	71	9	80
allowed	89	31	120
Total	160	40	200

Expected = (row total * column total) / Table total

Expected :

	No	yes	Total
not allowed	64	16	80
allowed	96	24	120
	160	40	200

a)

O	e	(O-e)	$(O-e)^2/e$
71	64	-7	0.7656
9	16	-7	2.0625
89	96	7	0.5104
31	24	7	2.0417

$\chi^2 = \Sigma = 6.3802$

χ^2 crit $\Rightarrow$ $d_f = 1$ $\alpha = 0.05$

$\chi^2_{crit} = 3.841$

We reject the null hypothesis and conclude that there is a significant relationship

b)

P.O	P.e	(P.O - P.e)	$(P.O - P_e)^2/P.e$
0.8875	0.8	0.0875	9.57×10^{-3}
0.1125	0.2	-0.0875	0.0382
0.7417	0.8	-0.0583	4.249×10^{-3}
0.2583	0.2	0.0583	0.01699

$\Sigma = 0.06901$

Cohen's $\omega = \sqrt{\Sigma (P_o - P_e)^2/P_e} = \sqrt{0.06901} = 0.2627$.

Cramer's $V = \sqrt{\frac{\chi^2}{(N)(\min(r-1)(c-1)}} = \sqrt{\frac{6.3802}{200(1)}}$.

$V = 0.1786$

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8. N, the total number of frequencies, should be reasonably large, say greater than 50

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