## Lesson 9.2.1

9-28. a. The 100 pieces of lined paper would have counts of 75.75 make and 24.25 miss. $\frac{75.75}{100}$ is now identical to $\frac{303}{400}$, and the events would be considered independent.

b. See table at right. The margins remain identical. We should not "expect" fewer pieces of lined paper, for example.

| | Lined | Graph | Copy | Card |
|---|---|---|---|---|
| Make | 75.75 | 75.75 | 90.9 | 60.6 |
| Miss | 24.25 | 24.25 | 29.1 | 19.4 |

9-29. $H_0$: The type of paper and outcome of the shots (make/miss) are independent. $H_A$: The type of paper and outcome of the shots (make/miss) are not independent.

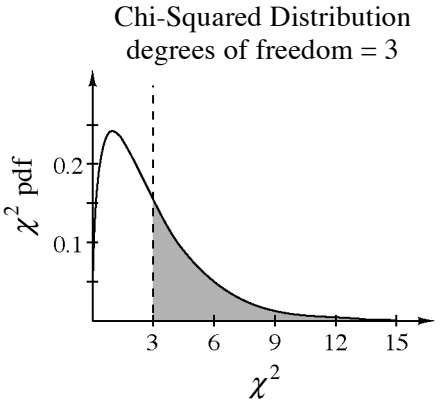
9-30. See table at right. $\chi^2 = 2.9850$

| | Lined | Graph | Copy | Card |
|---|---|---|---|---|
| Make | 0.2979 | 0.0668 | 0.0397 | 0.3195 |
| Miss | 0.9304 | 0.2088 | 0.1241 | 0.9979 |

9-31. We can assume that the paper in the sample represents a random sample. It was stated that Aliah randomly chose paper of each type. Aliah also attempted to ensure that each toss is independent. All expected counts are well above 5.

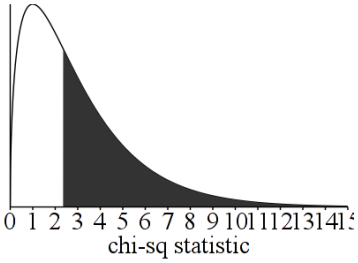
9-32. Aliah is correct. The hidden values can all be reconstructed. The degrees of freedom are 3, not 7.

9-33. See diagram at right. $p$-value = 0.3939




9-34. Because the $p$-value is quite high, there is not sufficient evidence to reject the null hypothesis. It cannot be concluded that the type of paper has an influence on the outcome of the shots. Her group will conclude that there is insufficient evidence to show the type of paper and the outcome of the shots are not independent.

9-35. Identify: Chi-squared test of independence. $H_0$: There is no relationship between residential demographic and outlook on the economy (they are independent). $H_A$: There is a relationship between residential demographic and outlook on the economy (they are not independent). Sample evidence for $H_A$: observed frequencies do not match expected frequencies. $\alpha = 0.05$.
Check conditions: Random, to avoid bias: random selection was given in the description. Independent trials and large counts, so the sampling distribution is ≈ chi-squared: assumed that there are more than $10 \cdot 200$ in the population. See expected frequency table below. Expected frequencies are all greater than 5.
Calculate: df = $(2 - 1)(3 - 1) = 2$, $\chi^2 = \frac{(20-16.1)^2}{16.1} + ... + \frac{(69-64.8)^2}{64.8} = 2.3493$,
$p$-value = $x^2$cdf(2.3493,1E99, 2) = 0.3089.
Conclude: The $p$-value is greater than 0.05 so students cannot reject the null hypothesis and cannot conclude that there is a relationship between one's residential demographic and outlook on the economy.




| | Residential Demographic | | | |
|---|---|---|---|---|
| | Rural | Suburban | Urban | |
| Positive Opinion | 16.1 | 20.7 | 55.2 | 92 |
| Negative Opinion | 18.9 | 24.3 | 64.8 | 108 |
| | 35 | 45 | 120 | 200 |

9-36. Identify: Chi-squared test independence test. $H_0$: volume level and size of insect are independent. $H_A$: volume level and size of insect are not independent. Sample evidence for $H_A$: observed frequencies do not match expected frequencies. $\alpha = 0.05$.
Check conditions: Random sample, to avoid bias. It is assumed that this represents an SRS. Independent trials and large counts, so the sampling distribution is ≈ chi-squared. All expected counts are higher than 5 (the smallest is 32.01) and that each insect was independently gathered.
Calculate: $\chi^2 = 1.0277$, df = 4, $p$-value = 0.9056.
Conclude: Because the $p$-value is so large (much higher than any typical level of significance), students fail to reject $H_0$. Students cannot conclude that the volume level and size of insect are related.

9-37. a. Normal distribution, $\mu = 18$, $\sigma = 15$. $P(X > 30) = 0.2119$

b. Binomial distribution, $n = 7$, $p = 0.2118554$. $P(X \geq 3) = 1 - P(X \leq 2) = 0.169$

9-38. a. This is a systematic sample. The population of interest is soccer fans at that game.

b. This is a voluntary response sample. The population is all households with students in the district who have strong feelings about the new stadium.

c. This is a cluster sample. The population is all households in the district.