

### Chi-Squared Goodness-of-Fit Tests

1. A class of statistics students examined a sample of 541 Reese's Pieces candies and found 273 were orange, 154 were brown, and 114 were yellow.

Conduct a goodness-of-fit test of whether the distribution of colors in the population of all Reese's Pieces is 50% orange, 25% brown, and 25% yellow. Report all aspects of the test, including a check of technical conditions, and summarize your conclusion.

Color	Orange	Brown	Yellow	Total
Expected	270.5	135.25	135.25	541
Observed	273	154	114	541

$H_0$ : prop. of R.P. is as hyp. (50% orange, 25% brown, 25% yellow)  
 $H_a$ : at least one of the prop. of R.P. colors differs from

• all exp. values  $\geq 5$   
 (smallest 135.25)

• consider the 541 R.P.  
 an SRS of all R.P.

$$\chi^2 = \frac{(273-270.5)^2}{270.5} + \frac{(154-135.25)^2}{135.25} + \frac{(114-135.25)^2}{135.25}$$

$$\chi^2 = 5.96$$

$$df = 3 - 1 = 2$$

$$p \text{ value} = Pr(\chi^2 > 5.96) = .0507$$

With a p-value of .0507, this is not sign. at  $\alpha = .05$ . Fail to reject  $H_0$

Not enough evid. to say the

3 colors of R.P. are

not 50% o / 25% br / 25% y

2. Gregor Mendel's groundbreaking studies in genetics relied heavily on chi-square tests to compare how well his observed data conformed to his theory's predictions. In one study, he crossed two hybrid pea plants and recorded the form (round or wrinkled) and albumen color (yellow or green) of the fertilized seeds. His theory predicted these should appear in the following proportions;

Round, Yellow	Wrinkled, Yellow	Round, Green	Wrinkled, Green
9/16	3/16	3/16	1/16

The observed counts in the 556 fertilized seeds follow:

	Round, Yellow	Wrinkled, Yellow	Round, Green	Wrinkled, Green	Total
Observed	315	101	108	32	556
Expected	312.75	104.25	104.25	34.75	556

Conduct a chi-square test to assess how well the observed counts fit Mendel's predictions. Report all aspects of the test and write a brief report summarizing your conclusion and explaining the reasoning process.

$H_0$ : prop. of types of peas is as Mendel predicted.

$(P_{RY} = 9/16, P_{WR} = 3/16, P_{RG} = 3/16, P_{WG} = 1/16)$

$H_a$ : at least one of the prop. <sup>of type of pea</sup> is not as expected.

- all exp. values  $\geq 5$   
(smallest = 34.75)
- 556 seeds can be considered an SRS of all peas.

$$\chi^2 = \frac{(315 - 312.75)^2}{312.75} + \frac{(101 - 104.25)^2}{104.25} + \frac{(108 - 104.25)^2}{104.25} + \frac{(32 - 34.75)^2}{34.75}$$

$\chi^2 = .47$

$df = 4 - 1 = 3$

$p\text{-value} = pr(\chi^2 > .47) > .25$

with a p-value  $> .25$ , this is not sign. at any reasonable level. Fail to reject  $H_0$ .

Not enough evid. to say prop. of types of peas differs from Mendel's theory. (consistent w/ his theory)