## Chi square exercise

You have been playing backgammon with your friend for years, and so far, winning had been pretty equal. But lately, your friend had so much luck, rolling sixes after sixes, that you wonder whether he is cheating. You both use your individual set of "lucky" dice, and you decide whether his set is naturally lucky or whether it is not. Since you are a biology major with lots of time on your hand you decide to borrow one of his dice and roll them 1310 times, recording the number coming up each time.

What should your null-hypothesis be?

### Chi square worksheet

Results (observation)

| Number up | Observed | Expected |
|---|---|---|
| 1 | 170 | |
| 2 | 297 | |
| 3 | 210 | |
| 4 | 203 | |
| 5 | 190 | |
| 6 | 240 | |

Your result is certainly different from the expectation. But do you have enough evidence to accuse your friend of tampering with the dice? You decide to run a chi-square test to figure out how likely you would get such a deviation from expectation by chance alone.

**Chi square formula:**

**Chi square calculation**

| Number | O | E | (O-E) | $(O-E)^2$ | $(O-E)^2/E$ |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| Total | | | | | |

**Compare calculated with table value**

**Conclusion**

**With a partner**

1. In fruit flies, red eyes (W) are dominant over white eyes (w). A student performs a cross between a fly heterozygous for eye color and a white-eyed fly. The student counts the offspring and finds 65 red-eyed flies and 49 white-eyed flies.

2. What is the expected phenotypic ratio of this cross? _____

3. Using a chi-square test, determine if the deviation between the observed and the expected is the result of chance at a significance level of 0.05. First, formulate a null hypothesis: _____

| Phenotype | O | E | (O-E) | $(O-E)^2$ | $(O-E)^2/E$ |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| Total | | | | | |

4. Compare calculated with table value:

5. Come to a conclusion

Fruit fly exercise 2

In fruit flies, gray body (E) is dominant over ebony body (e). A fly heterozygous for body color and eye color (see above) is mated with a fly heterozygous for body color and with white eyes. This is the result:

- 15 flies with white eyes, ebony body;
- 31 flies with white eyes, gray bodies;
- 12 flies with red eyes and ebony bodies;
- 38 flies with red eyes and gray bodies.

**In your laboratory notebook:**
(You are welcome to work with a partner, but both of you need to report the results of this and the previous exercise in their notebooks).

a) Formulate your null hypothesis.

b) Calculate expected phenotypic ratio using a **Punnett square**.

c) Calculate the chi-square value using a table similar to the on above.

d) Compare the calculated value with the table value (confidence level 95%).

e) Reject or accept your null hypothesis.