<u>**CONCEPT:**</u> <u>CHI-SQUARE ANAYLSIS</u>

● A **chi-square test** is used to examine whether to expected result is closet enough to the observed result

    □ Genetics is never _____ you wont get a perfect 3:1 ratio or 9:3:3:1 ratio

        - A chi-square test is used to check if your numbers are close enough to expected ratio

        - *Observed numbers* – The numbers you actually get

        - *Expected numbers* – The numbers that you expected to get. The "perfect ratio" numbers
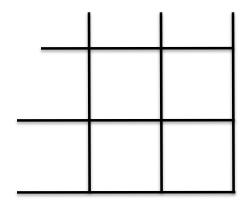
    □ Formula: - Observed = o

$$x^2 = \Sigma \frac{(o - e)^2}{e}$$

                                                  - Expected = e

PRACTICE :

    A. You bred a purple plant, which you think is heterozygous (Aa), with a homozygous recessive (aa) white plant. There were 120 offspring produces, 55 are purple and 65 are white. Was your red plant heterozygous? Assume Mendelian inheritance.

    1. Determine what the expected ratio of the heterozygous (Aa) cross with a homozygous recessive (aa) plants would be?

    -   If there are 120 offspring _____ would be purple and _____ would be white.
    -   These are your expected numbers

2. Use tUse the chi-square formula to calculate your chi square value

CLASS	O	E	(O-E)²	(O-E)²/ E
Red	55	60	25	0.42
White	65	60	25	0.42
			Total	0.84

3. Use the chi-square distribution table to determine whether or not your hypothesis is true.
   a. Calculate your *degrees of freedom*; df = # of variables - 1
      i. There are two variables in this problem (purple and white)
      ii. Df = 2 - 1 = 1
   b. Within your calculated degrees of freedom row, find where your chi-square value would be.
   c. Determine the range of probability (p value)
      i. For this problem is is 0.50-0.30, which is 50%-30%

Degrees of freedom (df)					x^2 value[18]						
1	0.004	0.02	0.06	0.15	0.46	1.07	1.64	2.71	3.84	6.64	10.83
2	0.10	0.21	0.45	0.71	1.39	2.41	3.22	4.60	5.99	9.21	13.82
3	0.35	0.58	1.01	1.42	2.37	3.66	4.64	6.25	7.82	11.34	16.27
4	0.71	1.06	1.65	2.20	3.36	4.88	5.99	7.78	9.49	13.28	18.47
5	1.14	1.61	2.34	3.00	4.35	6.06	7.29	9.24	11.07	15.09	20.52
6	1.63	2.20	3.07	3.83	5.35	7.23	8.56	10.64	12.59	16.81	22.46
7	2.17	2.83	3.82	4.67	6.35	8.38	9.80	12.02	14.07	18.48	24.32
8	2.73	3.49	4.59	5.53	7.34	9.52	11.03	13.36	15.51	20.09	26.12
9	3.32	4.17	5.38	6.39	8.34	10.66	12.24	14.68	16.92	21.67	27.88
10	3.94	4.87	6.18	7.27	9.34	11.78	13.44	15.99	18.31	23.21	29.59
P value (Probability)	0.95	0.90	0.80	0.70	0.50	0.30	0.20	0.10	0.05	0.01	0.001

4. Determine If you accept or reject your *null hypothesis*
    a. The **null hypothesis** states there is no difference between measured and predicted values
        i. In this problem, the null hypothesis would be that 55 red and 65 white plants is close enough to 60 red and 60 white plants – and therefore they are not different.
    b. Generally, you **accept** (fail to reject) the null hypothesis if the probability is greater than 5% or 0.05
    c. Generally, you **reject** the null hypothesis if the probability is less than 5% or 0.05

    - The probability for this question was between 30% and 50% (0.3 and 0.5) therefore we **accept** the null hypothesis

5. Figure out what the null hypothesis means for our actual problem
    a. Accepting the null hypothesis, means that the observed and expected aren't different
    b. Therefore, we are 95% confident that the purple plant was heterozygous

PRACTICE

Using the following F_2 phenotypes from a monohybrid cross, answer the following question.

F_2 Phenotype	# of F_2 Offspring
Red Flowers	892
White Flower	294

1. Which of the following null hypothesis is the best to test using the chi-square test?
    a. There is no difference between my values and an expected 3:1 ratio
    b. There is no difference between my values and an expected 2:2 ratio
    c. There is no difference between my values and an expected 9:3:3:1 ratio
    d. There is no difference between my values and an expected 3:2 ratio

Using the following F_2 phenotypes from a monohybrid cross, answer the following question.

F_2 Phenotype	# of F_2 Offspring
Red Flowers	892
White Flower	294

2. Which of the following represents the appropriate degrees of freedom for this problem?
    a. 1
    b. 2
    c. 3
    d. 4

Using the following F_2 phenotypes from a monohybrid cross, answer the following question.

F_2 Phenotype	# of F_2 Offspring
Red Flowers	892
White Flower	294

3. Using the chi-square formula, calculate the chi-square value.
   a. 0.321
   b. 0.191
   c. 0.450
   d. 0.005

4. Assuming a chi-square value of 0.191 and a single degree of freedom, what is the range of p-values?
   a. 0.70-0.50
   b. 0.90-0.80
   c. 0.50-0.30
   d. 0.95-0.90

5. If a chi-square value has led you to receive a p-value range of 0.70-0.50, will you accept or reject the null hypothesis?
    a. Accept the null hypothesis
    b. Reject the null hypothesis

6. Which of the follow statements is true when we *accept* a null hypothesis.
    a. The observed and expected values are different
    b. We are 95% confident that our observed and expected values are different
    c. We are 95% confident that our observed and expected values are the same
    d. We are 50% confident that our observed and expected values are the same