**The Chi-Square Test**

An important question to answer in any genetic experiment is how can we decide if our data fits any of the Mendelian ratios we have discussed. A statistical test that can test out ratios is the Chi-Square or Goodness of Fit test.

**Chi-Square Formula**



**Degrees of freedom (df)** = n-1 where n is the number of classes

Let's test the following data to determine if it fits a 9:3:3:1 ratio.

|  |  |
| --- | --- |
| **Observed Values**  | **Expected Values**  |
| 315 Round, Yellow Seed  | (9/16)(556) = 312.75 Round, Yellow Seed  |
| 108 Round, Green Seed  | (3/16)(556) = 104.25 Round, Green Seed  |
| 101 Wrinkled, Yellow Seed  | (3/16)(556) = 104.25 Wrinkled, Yellow  |
| 32 Wrinkled, Green  | (1/16)(556) = 34.75 Wrinkled, Green  |
| 556 Total Seeds  | 556.00 Total Seeds  |

Calculate the Chi-Square Value for the data above.

Calculate the degrees of freedom.

### A Chi-Square Table:

|  |  |
| --- | --- |
|  | **Probability** |
| **Degrees ofFreedom** | **0.9** | **0.5** | **0.1** | **0.05** | **0.01** |
| 1 | 0.02 | 0.46 | 2.71 | 3.84 | 6.64 |
| 2 | 0.21 | 1.39 | 4.61 | 5.99 | 9.21 |
| 3 | 0.58 | 2.37 | 6.25 | 7.82 | 11.35 |
| 4 | 1.06 | 3.36 | 7.78 | 9.49 | 13.28 |
| 5 | 1.61 | 4.35 | 9.24 | 11.07 | 15.09 |

Enter the Chi-Square table at df = 3 and we see the probability of our chi-square value is greater than 0.90. By statistical convention, we use the 0.05 probability level as our **critical value**. If the calculated chi-square value is less than the 0 .05 value, we accept the hypothesis. If the value is greater than the value, we reject the hypothesis. Therefore, because the calculated chi-square value is greater than the we accept the hypothesis that the data fits a 9:3:3:1 ratio.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Answers: The Chi-Square Test An important question to answer in any genetic experiment is how can we decide if our data fits any of the Mendelian ratios we have discussed. A statistical test that can test out ratios is the Chi-Square or Goodness of Fit test. **Chi-Square Formula** http://www.ndsu.edu/pubweb/~mcclean/plsc431/mendel/2-fig11a.gif**Degrees of freedom (df)** = n-1 where n is the number of classes Let's test the following data to determine if it fits a 9:3:3:1 ratio.

|  |  |
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| **Observed Values**  | **Expected Values**  |
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| 556 Total Seeds  | 556.00 Total Seeds  |

http://www.ndsu.edu/pubweb/~mcclean/plsc431/mendel/2-fig12a.gif**Number of classes** (n) = 4 **df** = n-1 + 4-1 = 3 Chi-square value = 0.47 Enter the Chi-Square table at df = 3 and we see the probability of our chi-square value is greater than 0.90. By statistical convention, we use the 0.05 probability level as our **critical value**. If the calculated chi-square value is less than the 0 .05 value, we accept the hypothesis. If the value is greater than the value, we reject the hypothesis. Threrefore, because the calculated chi-square value is greater than the we accept the hypothesis that the data fits a 9:3:3:1 ratio. A Chi-Square Table

|  |  |
| --- | --- |
|  | **Probability** |
| **Degrees ofFreedom** | **0.9** | **0.5** | **0.1** | **0.05** | **0.01** |
| 1 | 0.02 | 0.46 | 2.71 | 3.84 | 6.64 |
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