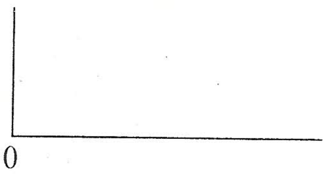
Chi-square (χ^2) distributions are a family of distributions that are distinguished from each other by their ______ ______

Typical χ^2 Distribution:



- Each χ^2 distribution is ______ and ______
- Like other probability distributions, ______ ______
- Each χ^2 distribution, regardless of degrees of freedom, ______ ______
- As the number of degrees of freedom increases, χ^2 distributions become more ______ and less ______
- Two of the primary uses for χ^2 distributions are to test for ______ and ______.

Chi-square distributions can be used to test how well data fits with a ______, much like we do with 1-Proportion Z tests and 2-Proportion Z tests, but with ______. χ^2 distributions can also be used to test for ______. This is appropriate for multivariate data that is displayed in ______. In either case, we use a process similar to what we used for hypothesis testing: we identify the hypothesized distribution:

- state our ______ and ______
- determine the number of ______
- check that the ______ are met for a test
- calculate a ______ for the data that has been gathered
- calculate a ______ for the statistic, and
- reach a ______ to either reject or fail to reject the null hypothesis.

Using χ^2 to test for Goodness of Fit

Suppose that the M&M/Mars Company claims that the distribution of colors in M&M candies is 30% brown, 20% each of yellow and red, and 10% each of orange, green, and blue. Suppose further that a class of Statistics students examines a sample of 100 M&M candies and gathers the following data:

	Brown	Yellow	Red	Orange	Green	Blue	**Total**
Observed	38	25	15	12	8	2	100
Expected							

Complete the table by calculating the number of each color that would be expected if the distribution of candies matched the manufacturer's claims, and the total for that row.

Before we can conduct a test for goodness of fit, we need to state the ______ ______:

H_0: The actual proportion of each color ______ the manufacturer's claims. (30% brown, 20% each of yellow and red, and 10% each of orange, green, and blue.)

H_a: The actual proportion of each color ______ what the manufacturer claims.

The number of ______ is $n - 1$, or $6 - 1$, which is 5.

We must assume that these 100 M&M candies represent an ______ of all M&M candies. We must check that all of the expected values in the table are at least 1, which they are, and that no more than 20% are less than 5. Since they are all at least 5, we have verified the technical conditions.

The test statistic is $\chi^2 = \Sigma \frac{(O-E)^2}{E}$. Filling in the appropriate values, we get

$$\chi^2 = \frac{(38-30)^2}{30} + \frac{(25-20)^2}{20} + \frac{(15-20)^2}{20} + \qquad + \qquad + \frac{(2-10)^2}{10}$$

$$= 2.13 + 1.25 + 1.25 + 0.4 + 0.4 + 6.4$$

$$\chi^2 = 11.83$$

Using the χ^2 table and the appropriate degrees of freedom (___), we determine that $0.025 < p < 0.05$. This represents enough evidence to ______ ______ at the 0.05 level, so the actual proportion of each color for M&M candies may be ______.