14. Longevity Listed below are the numbers of years that popes and British monarchs (since 1690) lived after their election or coronation (based on data from *Computer-Interactive Data Analysis*, by Lunn and McNeil, John Wiley & Sons). Treat the values as simple random samples from a larger population. Use a 0.05 significance level to test the claim that both populations of longevity times have the same variation.

Popes:	2	9	21	3	6	10	18	11	6	25	23	6	2	
	15	32	25	11	8	17	19	5	15	0	26			
Kings and Queens:	17	6	13	12	13	33	59	10	7	63	9	25	36	15

15. Heights Listed below are heights (cm) of randomly selected females and males taken from Data Set 1 in Appendix B. Use a 0.05 significance level to test the claim that females and males have heights with the same amount of variation.

Female:	163.7	165.5	163.1	166.3	163.6	170.9	153.5	155.7	153.0	157.0
Male:	178.8	177.5	187.8	172.4	181.7	169.0	186.9	183.1	176.4	183.4

16. Weights Listed below are weights (kg) of randomly selected females and males taken from Data Set 1 in Appendix B. Use a 0.05 significance level to test the claim that males have weights with more variation than females.

Female:	59.3	74.5	77.7	97.9	71.7	60.9	60.5	88.2	43.8	47.9
Male:	64.4	61.8	78.5	86.3	73.1	58.5	134.3	79.8	64.8	58.1

Large Data Sets. ***In Exercises 17 and 18, use the indicated Data Sets from Appendix B. Assume that both samples are independent simple random samples from populations having normal distributions.***

17. Weights Repeat Exercise 16 using all of the weights listed in Data Set 1 in Appendix B.

18. M&Ms Refer to Data Set 20 in Appendix B and use the weights (g) of the red M&Ms and the orange M&Ms. Use a 0.05 significance level to test the claim that the two samples are from populations with the same amount of variation.

9-5 Beyond the Basics

19. Count Five Test for Comparing Variation in Two Populations Use the original weights of pre-1964 quarters and post-1964 quarters listed in Data Set 21 in Appendix B. Instead of using the F test, use the following procedure for a "count five" test of equal variation. What do you conclude?

a. For the first sample, find the absolute deviation of each value. The absolute deviation of a sample value x is $|x - \bar{x}|$. Sort the absolute deviation values. Do the same for the second sample.

b. Let c_1 be the count of the number of absolute deviation values in the first sample that are greater than the largest absolute deviation value in the other sample. Also, let c_2 be the count of the number of absolute deviation values in the second sample that are greater than the largest absolute deviation value in the other sample. (One of these counts will always be zero.)

c. If the sample sizes are equal ($n_1 = n_2$), use a critical value of 5. If $n_1 \neq n_2$, calculate the critical value shown below.

$$\frac{\log(\alpha/2)}{\log\left(\dfrac{n_1}{n_1 + n_2}\right)}$$

d. If $c_1 \geq$ critical value, then conclude that $\sigma_1^2 > \sigma_2^2$. If $c_2 \geq$ critical value, then conclude that $\sigma_2^2 > \sigma_1^2$. Otherwise, fail to reject the null hypothesis of $\sigma_1^2 = \sigma_2^2$.