1. Explain why the expected value for an F-ratio is equal to 1.00 when there is no treatment effect.

3. What happens to the value of the F-ratio in analysis of variance if the difference between sample means increases? What happens to the value of F if the sample variability increases?

6. Use the following set of data.
   a. Without doing any calculations (just look at the data), what value should be obtained for the variance between treatments? ($MS_{between}$ = ?)
   b. Based on your answer to part a, what value would be obtained for the F-ratio for these data?
   c. Calculate $SS_{between}$ and $MS_{between}$ to verify your answers.

TREATMENTS		
I	II	
1	2	
4	5	$G = 16$
0	0	$\Sigma X^2 = 56$
3	1	
$T = 8$	$T = 8$	
$SS = 10$	$SS = 14$	

7. For the following set of data, without doing any calculations (just look at the data), what value should be obtained for the variance within treatments? (MS_{within} = ?)

TREATMENTS		
I	II	
1	3	
1	3	$G = 16$
1	3	$\Sigma X^2 = 40$
1	3	
$T = 4$	$T = 12$	

12. Several studies indicate that handedness (left-handed/right-handed) is related to differences in brain function. Because different parts of the brain are specialized for specific behaviors, this means that left- and right-handed people should show different skills or talents. To test this hypothesis, a psychologist tested pitch discrimination (a component of musical ability) for three groups of subjects: left-handed, right-handed, and ambidextrous. The data from this study are as follows:

RIGHT-HANDED	LEFT-HANDED	AMBIDEXTROUS	
6	1	2	
4	0	0	
3	1	0	$G = 30$
4	1	2	$\Sigma X^2 = 102$
3	2	1	
$T = 20$	$T = 5$	$T = 5$	
$SS = 6$	$SS = 2$	$SS = 4$	

Each score represents the number of errors during a series of pitch discrimination trials.
   a. Do these data indicate any differences among the three groups? Test with $\alpha = .05$.
   b. Use the F-max test to determine whether these data satisfy the homogeneity of variance assumption (see Chapter 10).

14. A pharmaceutical company has developed a drug that is expected to reduce hunger. To test the drug, three samples of rats are selected with $n = 10$ in each sample. The first sample receives the drug every day. The second sample is given the drug once a week, and the third sample receives no drug at all. The dependent variable is the amount of food eaten by each rat over a one-month period. These data are analyzed by an analysis of variance, and the results are reported in the following summary table. Fill in all missing values in the table. (*Hint:* Start with the *df* column.)

SOURCE	SS	df	MS	
Between treatments	___	___	___	$F = 12$
Within treatments	54	___	___	
Total	___	___		

20. Sheldon (1940) examined the relationship between personality characteristics and physical characteristics (body shape). He identified three categories of body shape: endomorph, ectomorph, and mesomorph corresponding to rounded, thin, and muscular, respectively. He then evaluated personality characteristics that tend to be associated with each body type. One relationship Sheldon examined involved sociability and body type. Specifically, endomorphs tend to be more social, and ectomorphs tend to be more private. The following hypothetical data represent an attempt to demonstrate this relationship. Sociability scores were obtained for three separate samples representing the three different body types. Do these data indicate significant differences in personality between groups with different physical characteristics? Test with $\alpha = .05$.

ENDOMORPHS	ECTOMORPHS	MESOMORPHS
23	19	18
25	17	14
19	16	15
20	21	11
23	15	17

23. A psychologist is interested in the extent to which physical attractiveness can influence judgment of other personal characteristics such as intelligence or ability. The psychologist selected three groups of subjects who were to play the role of a company personnel manager. Each subject was given a stack of job applications, each of which included a photograph of the applicant. One of these applications was previously selected as the test stimulus. For one group of subjects, this application contained a photograph of a very attractive person. For the second group, the photograph was of an average-looking person. For the third group, a photo of a very unattractive person was attached to the application. The subjects were instructed to rate the quality of each job applicant (0 = "very poor" to 10 = "excellent"). The psychologist recorded the rating of the test stimulus for each subject. These data are as follows:

ATTRACTIVE			AVERAGE[a]			UNATTRACTIVE		
5	4	4	6	5	3	4	3	1
3	5	6	6	6	7	3	1	2
4	3	8	5	4	6	2	4	3
3	5	4	8	7	8	2	1	2

a. Compute the means of the groups, and draw a graph showing the results.
b. Use an ANOVA with $\alpha = .05$ to determine whether there are any significant differences among these three groups.