

Experimental Design 603
Practice Problems 1

1. The following experimental design was used to evaluate the effects of 3 diets and 4 dosages of a growth promoting implant on the growth of steers:

There are 15 pens with 4 steers in each for a total of 60 steers. The 3 diets are assigned to the 15 pens completely at random so that each diet is given to 5 pens. Within each pen the 4 dosages of growth promotant are assigned to the four steers at random. This is done independently for each pen.

- a. What is the experimental unit with regard to diet comparisons? With regard to dosage comparisons?
 - b. Give the sources of variation and degree of freedom for an analysis of this experiment.
2. A Latin square design was used to compare four diets (A,B,C,D) using four cows in four periods.

		Cows			
		1	2	3	4
Period	1	B	A	C	D
	2	A	D	B	C
	3	C	B	D	A
	4	D	C	A	B

- a. Write out the ANOVA and indicate F tests.
 - b. Assuming the diets were as follows, what orthogonal contrasts would you use to test main effects and interactions?
- A = first cut alfalfa, cut in early bud stage
 B = first cut alfalfa, cut in early bloom stage
 C = second cut alfalfa, cut in early bud stage
 D = second cut alfalfa, cut in early bloom stage
3. The effect of each of three preparations on the glycogen content of liver was studied as follows:

Each of the three preparations (control, compound 217, compound 217 + sugar) was used on two cottontail rabbits (for a total of six rabbits), and four determinations of liver glycogen were made per rabbit.

The objectives of this experiment are to determine if there is significant difference among the three treatments (preparations) and to estimate the two variance components (readings within rabbits or sampling error, and rabbits within treatments or experimental error).

- a. Identify the experimental units and the sampling units. How many replicates of each treatment are there? Are the treatments fixed or random?
- b. Complete the analysis of variance table and indicate appropriate F-tests.

1. Split plot: MP=pen, SP=steer
 Diet: Pen
 Dosage: Steer

Source	df
Diet	2
Pen within diet	$(5-1)3=12$
Dosage	3
Diet*Dosage	6
Error	$59-23=36$
Total	59

2. Latin Square: columns=cows, rows = periods
 a)

Source	df
Diet	3
Cow	3
Period	3
Error	6
Total	15

- b) Treatments are arranged in a 2 x 2 factorial

Contrasts: Main effect of cut: A+B-C-D
 Main Effect of stage: A-B+C-D
 Interaction: A-B-C+D

3. Random sampling within rabbits
 Experimental units: rabbits
 Sampling units: glycogen tests
 Replications: 2
 Treatments are fixed

Source	df
Trt	2
Rabbit within Trt	3
Glycogen within Rabbit	18
Total	23