

Statistics 5301 — Exam 2
February 27, 1998
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NAME _____

ID# _____

This exam is open book, open notes; you may use a calculator. **Do your own work!** Use the back if more space is needed. Each question is worth 10 points.

Please attach your data analysis notes for these data sets to your exam with the paper clips provided in the front of the room.

Questions 1 through 3 relate to the perch data. **Provide some justification for your answers!**

1. Describe the experimental design that was used. Tell me about treatments, units, responses, randomization, blocking (if any) and so on.

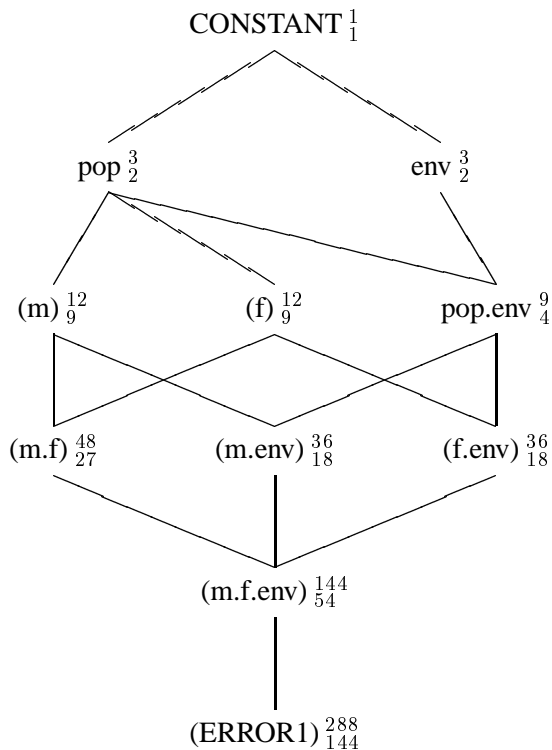
2. Describe how you checked assumptions and what you decided. Tell me about nonnormality, nonconstant variance, outliers, and so on. Were there any problems that required fixing, and could you fix the problems?

3. What did you conclude from the experiment?

4. Nonstarter bacteria may affect the flavor of cheese. A food manufacturer wishes to study the effects of adding three different nonstarter cultures as well as adding no nonstarter to its cheeses. Cheese is made in vats, and it is believed that vats processed early, middle, and late in the day tend to be different. Four early vats are assigned at random to the four treatments; this is repeated for four midday vats and four late day vats. One block of cheese is sampled from each vat, aged 180 days, and then judged for flavor (a single number per block of cheese).

Describe the design used (e.g., completely randomized, randomized complete block, Latin square, BIBD, etc); tell me about treatments, units, blocking (if any), and so on. Give a skeleton anova (sources and df only).

5. An experiment was conducted to study the effects of genetics and the environment on *Chamaecrista fasciculata* (hereinafter Cf), an annual prairie plant. Cf is hermaphroditic, meaning that each plant is both male and female. We have three different populations of Cf. From each population, we choose 4 random plants to be males and 4 random plants to be females. Each of the “male” plants is used to pollinate a flower on each of the “female” plants (ie, 4 flowers per “female” plant). From each flower, we take 6 seeds (a total of 288 seeds used). These seeds are then divided into three groups of two at random, with the three groups being grown under different environmental conditions. The response of interest is height of the resulting plants. A Hasse diagram for this experiment is given below.



a) What is the expected mean square for environment?

b) What is the denominator (error) to use when testing the environment by male interaction?

6. Many pages on the World Wide Web contain advertisements for other commercial sites. So, Web page A may have an advertisement for page B. Everytime someone on page A clicks on the advertisement, then the owner of page B pays the owner of page A a fee. Thus it is to owner A's advantage to choose advertisements that get lots of hits (clicks).

There are three different ads available for B, and owner A gets to experiment before deciding on an ad for long-term use. Owner A is trying to choose an ad that will lead to more hits. Today is Friday, and the long-term ad needs to be in place on Monday, so there are three days to work with. Owner A knows that there is considerable variation in numbers of hits between days. Owner A also knows that there is considerable variation in hits between day time (7AM-5PM), evening (5PM-11PM), and overnight (11PM-7AM).

Design an experiment for owner A to compare the three ads. Tell me about units, treatments, responses, randomization, blocking (if any), and so on.

7. We wish to study how the hormone melatonin affects sleep habits. Stimulation of the retina by light reduces the body's natural production of melatonin.

The subjects will be 32 volunteers from a psychology class. Not much is known about the subjects except they are all male and 18-25 years of age. All subjects record their hours of sleep every night for two weeks. They then begin treatment and continue to record their hours of sleep every night for two weeks. The response for a subject is the average change in sleep hours. Half the subjects should receive melatonin, while the other half should get a placebo. Half the subjects should spend 7-8PM every day in a bright-light room. The other subjects spend the same time in a normal-light room.

Design an experiment to study light and melatonin. Tell me about units, treatments, responses, randomization, blocking (if any), and so on.

8. The EPA is trying to encourage volunteer monitors to check the health of streams by collecting and classifying macroinvertebrates in the streams. (Generally speaking, streams with more kinds of invertebrates, greater diversity, are healthier.)

Only a subsample of each collection of invertebrates is actually classified. There is a “professional” method for picking a subsample, and two “volunteer” methods for picking the subsample. We wish to determine if the three methods lead to the same average diversity.

We have 30 collections, and we expect substantial collection to collection variability in diversity. Each collection is big enough to be classified by two methods, but not big enough to be classified by all three methods.

Design an experiment to study the subsampling methods. Tell me about units, treatments, responses, randomization, blocking (if any), and so on.