STATISTICS MASTER'S/PH.D. QUALIFYING EXAM
August 10-14, 2000

DIRECTIONS: Turn in your answers by noon, August 14 to the main office or the proctor of the exam. Write your ID number on the papers, do not write your name. Answer each question in three or less typed double spaced pages. You are allowed to create an appendix for each answer, but there is no assurance that the appendix will be looked at. You can maximize the chances of getting it looked at by organizing it well.

You are to work the exam independently without consulting any other being in any form. If you are confused about the wording of any question, contact a professor.

1. In inner-layer fabrication of circuit boards, copper-clad glass epoxy laminate panels are cleaned. Dry-film photoresist is applied to the panels under lamination temperature and pressure using a hot-roll laminator. The circuitry is plotted on film, placed on the panel and exposed to ultraviolet radiation. The photoresist below the opaque area of the film is not affected, the rest is polymerized. The experiment involves three factors, A: surface preparation of the panels which is Scrub, Pumice, or Chemical, B: Preheating of the panels, Yes or No, and C: Lamination pressure, 20, 40, or 60 psi. The current operating levels are Scrub, No, and 40. The dependent variable y is a measure of short circuits in the board. Analyze the data assuming no three factor interaction.

A	B	C	y
Scrub	No	40	26.0
Scrub	No	60	19.0
Scrub	No	80	12.6
Pumice	No	40	16.4
Pumice	No	60	11.8
Pumice	No	80	16.9
Chem	No	60	12.8
Chem	No	80	19.0
Chem	No	40	17.5
Scrub	Yes	80	11.9
Scrub	Yes	40	9.8
Scrub	Yes	60	13.3
Pumice	Yes	60	16.9
Pumice	Yes	80	11.6
Pumice	Yes	40	9.2
Chem	Yes	80	7.5
Chem	Yes	40	21.2
Chem	Yes	60	16.4

2. Consider a 2^7 factorial. Give a good design for performing a $1/4$ replication. Try to avoid aliasing main effects with each other and with two-factor interactions. Also try to avoid aliasing two-factor interactions with other two-factor interactions. Describe how well your design works. Give your defining effects. Give the aliases of A and of AB and show how they are found.

3. The California Child Health and Development Study involved women on the Kaiser Health plan who received prenatal care and later gave birth in the Kaiser clinics. Approximately 19,000 live-born children were delivered in the 20,500 pregnancies. We consider the 680 live-born white male infants in the study. Data were collected on a variety of features of the child, the mother, and the father.

   The columns in the data set are, from left to right:

   1) ID

   2) child's head circumference (inches)

   3) child's length (inches)

   4) child's birth weight (pounds)

   5) gestation (weeks)

   6) maternal age (years)

   7) maternal smoking (cigarettes/day)

   8) maternal height (inches)

   9) maternal pre-pregnancy weight (pounds)

   10) paternal age (years)

   11) paternal years of education

   12) paternal smoking (cigarettes/day)

   13) paternal height (inches)

   The main interest here is to assess the impact of mother's smoking behavior on the child's birth weight. For your analysis, define 3 groups based on mother's smoking history:

   (1) Mother does not smoke (i.e. no cigarettes per day)

   (2) Mother smoked less than 1 pack of cigarettes per day (i.e. number per day is at least 1, but less than 20 per day)

   (3) Mother smoked at least 1 pack of cigarettes per day.

   Develop a model that allows you to quantify the effect of mother's smoking behavior on the child's birth weight, accounting for other maternal and paternal features that appear to be important. As part of your writeup, make sure that you quantify the effect of mother's smoking on birth weight.

   The data are in the file ~`fletcher/kaiser.dat`. They are also available on the web at `stat.unm.edu/~fletcher/kaiser.dat`