AP Sample Test

AP1. C. A family with two children in high school is twice as likely to be selected by this method as is a family with one child in high school, so the computed mean is likely to be too high. When finding the mean number of children per family, it's important to randomly select families rather than select children. The sampling method in choice B will have a sampling distribution with a lot of variation. For that reason this method isn't a very good sampling plan, but on average it is a method that should give the correct mean.

AP2. E. Listeners in the sample are the people who chose to call in.

AP3. B

AP4. A. Choice A is not a good reason for choosing this plan because stratification reduces variability not confounding. Choice D is a good reason because stratifying tends to reduce variability when the strata have different averages.

AP5. A. The two treatments are expected to result in different responses from men and women, so form a block of men and a block of women and then randomly assign the two treatments within these blocks.

AP6. A

AP7. A. A control group is not necessary as long as there are two or more treatments that can be compared.

AP8. D

AP9. A design that uses no blocks would be a completely randomized design. Randomly divide the available subjects into four treatment groups (of equal size, if possible) and then randomly assign one of the background colors (treatments) to each group. Each person should then be independently timed in threading a needle with white thread. All needles and thread should be of the same size and type. The main weakness of this design is that there will probably be considerable variation from subject to subject within groups, which will serve to mask any differences in times between the treatments (colors of background).

A block design requires somewhat homogeneous units within each block with regard to variables related to the response (time to thread a needle). These could involve steadiness of nerves and perception of color, among others. One way to decide on blocks is to do a trial run of the experiment on every subject, perhaps using a neutral color that is not one of the treatments, and grouping subjects into blocks such as slow, medium, and fast, based on the trial run. Blocks should be of equal size, a multiple of four, so that each treatment is used the same number of times in each block. Randomly assign treatments to subjects within each block. The block design should reduce the subject-to-subject (within-block) variation so that any observed treatment differences are more easily detected.

A repeated measures design is a block design that uses each subject as a block. In this design each subject would be assigned each of the four treatments (background colors) in random order and timed in threading the needle with the white thread. This design is the ultimate in reducing subject-to-subject variability, but it has the major drawback that learning may take place along the way. Thus, the colors presented later may produce lower times simply because of the experience of the subject. This *carryover effect* can seriously bias the results of the study. (On the other hand, the carryover effect could be one of fatigue, which would make the later times slower than the earlier ones.)

All in all, a block design by grouping subjects seems the best as it has no major drawbacks and reduces the subject-to-subject variability.

AP10. Because the mailed portion of the census depends on the goodwill of residents to return the questionnaires, many people are left uncounted. The United States Conference of Mayors describes why it is important to count every resident,

> It has been long-standing policy of The U.S. Conference of Mayors that an accurate census count is vitally important to every city. Beyond the importance of the count to fair representation of citizens in federal and state legislatures, the census figures are the basis for the distribution of funds for a variety of programs—housing, community and economic development, transportation, job training and low income home energy assistance, among them. If a city's population is undercounted, that city stands to lose both federal and state funds. The U.S. Bureau of the Census estimates that in the 1990 census, eight million people were undercounted, and another four million were counted twice. [www.mayors.org]

Making an intensive effort to find those not counted and estimating the undercount

for a sample of regions seems like a good way to improve the accuracy of the census count. The adjustment to the census count through sampling can correct many deficiencies of the mail campaign if the Census Bureau pays careful attention to the kinds of errors discussed below.

The sampling plan for adjustment has three large weaknesses. First, many of those not found by the mail campaign are also difficult to find in a follow-up survey of geographic regions, so the sampling will still underestimate some segments of the population. Second, the matching of records is subject to error. Many of the census forms are incomplete or filled out incorrectly by the respondents, sometimes intentionally, so that deciding whether or not a sampled household has already filled out a form is not always easy. In addition, a sampled block may show completed census forms for persons who are no longer in that block or may not even exist. (It is possible for a block to be overcounted.) Third, applying adjustments from a sampled region to other similar regions for which no sample data are taken is also error prone.