Stat 500: HW 1, Solution

1. Design-based p-values and confidence intervals

   (a) Use the randomization data (lab1bigex1.txt) to compute the p-value. For the one-sided test of H_o difference = 0, there are 11 values larger than 4.49, so $p = (11+1)/(500+1) = 0.024$ or 2.4%. For the one-sided test of H_o ratio = 1, there are 11 values larger than 3.84, so $p = (11+1)/(500+1) = 0.024$.

   (b) For the two-sided test of H_o difference = 0, there are 10 values less than -4.49 and 11 larger than 4.49, so $p = (21+1)/(500+1) = 0.044$ or 4.4%. For the two-sided test of H_o ratio =1, there are 10 values less than 0.2604 and 11 values more than 3.84, so $p = (21+1)/(500+1) = 0.044$.

   (c) Use the bootstrap data (lab1bigex2.txt) to get the confidence interval. Endpoints of the 95% confidence interval are given by the 0.025*500 =12.5, rounded to 13'th sorted value, and the 0.975*500 = 487.5, rounded to 488'th sorted value.
   95% confidence interval for the difference is (0.440, 10.257).
   95% confidence interval for the ratio is (1.226, 9.495).
   Note: Notice that these 13'th and 488'th observations values are symmetrical from the ends of the sorted list. The 13'th largest is skip the first 12 and take the 13'th. The 488'th is skip the 12 largest (the 500'th, ... 489'th) and take the next, the 13'th from the top.

   (d) Same calculation as in part 1c, but using the 0.005*500 = 2.5, i.e. 3'rd, and 0.995*500 = 497.5, i.e. 498'th observations.
   99% interval for the difference is (-0.406, 11.553).
   99% interval for the ratio is (0.817, 10.499)

2. Cholesteral and tv watching

   (a) An observational study
   Note: I didn't ask for an explanation. If I had, mine is that the investigators did not assigned children to amounts of TV watching.

   (b) No, the headline is not an appropriate summary, because causal inference can not be made from an observational study.

3. Anti-smoking treatments

   (a) Randomized experiment

   (b) eu=smoker, ou=measurement or smoker/week

4. Fat measurement

   (a) randomized experiment

(b) eu=piece of meat, ou=piece of meat (my answer)
Note: Bailey's book says 'ou not clear' when the object being measured is not specifically stated. That answer is acceptable here.

5. Paper colour on windshields

(a) randomized experiment

(b) eu=car (my answer), ou=car (my answer)
Notes:
1) Bailey's book says 'ou not clear' when the object being measured is not specifically stated. That answer is acceptable here.
2) We accepted "eu=questionaire" as correct, since the color is assigned to the questionaire. I don't like that as much because the colored questionaire is then RANDOMLY assigned to the car. So the eu is the car?.

6. poverty and reading

(a) observational study

(b) eu (really an analog of the eu) = school, ou=student
The ou is clear (one measurement per student). A reasonable surrogate for the eu is the school because all students in a school are in the same neighborhood. If neighborhood poverty were randomly assigned, it would be to the school, not to individual student.

7. poverty and reading, 2nd version

(a) observational study

(b) eu (analog) = school, ou= school
Averaging students changes the ou. There is now one observation per school. No change to the eu

8. Concrete longevity

(a) experiment with non-randomized treatments

(b) eu (analog) = either mile or collection of 5 one-mile segments, ou=mile
Again, the ou is clear. There are two reasonable answers for the eu. Again, I think of what might have happened if treatments were randomly assigned. Here there are two possibilities: a) treatments were randomly assigned to miles, perhaps after grouping into 3 mile long blocks. This randomization breaks up the cylical repeat of treatments. b) randomization that maintains the cyclical repeats. In this case, treatments are randomly assigned to the first three one mile segments. That treatment order is repeated along the freeway. The unit that was "randomized" to treatment A is the collection of miles 1, 4, 7, 10, and 13. If you had something else reasonable, that was accepted for full credit.