

## **Problem Set 1 Solution**

**Question 1 & 2. See attached.**

**Question 3.**

**review exercise 1.**

False. Even with the best equipment available, there is chance error in measurement in any experiment. To measure precisely, replication of the experiment is necessary.

**review exercise 2.**

- (a) Bias is a systematic error which happens all the time when you do experiments. The possible source of bias here is equipment - the tape measure. If the tape measure was incorrectly produced by the manufacturer in the first place, you would have biased results.
- (b) Cloth tape is more vulnerable to bias. It could be loosened over time, which will generate a systematic error or bias. Of course, a steel tape also can produce bias; if it was used under a really high temperature, for example. Considering how hot it would be for a steel tape to be deformed, the cloth tape is relatively more biased.
- (c) Yes. By repetitive usage of the cloth tape you might expect it to stretch. Then, the amount of bias will increase over time.

**review exercise 3.**

- (a) False. Bias is a *systematic* error.
- (b) False. Chance errors change from measurement to measurement whereas bias moves measurement in one direction.
- (c) True. The problem with bias is that we cannot see whether we have a bias or not by just looking at the results. We need some theoretical basis to compare and figure out whether our outcome is biased or not.

**special review 13.**

- (a) It is true that the older a person is, the more vulnerable they are to any kind of disease. Heart attack is not an exception. By controlling for age, we can eliminate the age effect on heart disease.
- (b) The experiment is about whether different kinds of job activities particularly increase the exposure to a heart attack. Thus, we need a sufficient latent period on the job until a job starts to influence on an individual's health.
- (c) In general, the more educated people are, the more they are conscious of their health and diet. Even though executive staffs are not active at their job either, living conditions, level of private exercise and their recognition of its importance and diet can be quite different from those of conductors and drivers. In order to eliminate the effects of confounding factors (i.e. diet, living condition etc.), it is preferable to choose a sample group which has very similar controlling factors other than job activity.
- (d) The first investigators did not consider the initial health condition of samples. If drivers were initially overweight, they would already be more susceptible to heart. In addition, people can select a particular job due to their health condition. The sicker people might choose to be drivers, because it is relatively easier than conductor. Thus, the health conditions when they started their jobs should be controlled.
- (e) The second investigator group recorded the initial uniform size to see whether there was any change in body size among groups. The change of uniform sizes will control for groups' initial health condition and body sizes. By doing so, she/he can see whether the effects of job activities caused one group to gain more weights and to be more vulnerable to heart disease than the other group.

### **special review 15.**

First of all, it seems that the researcher has confused the concept of control group with treatment group. If she/he is interested in the effect of pretrial conference on trial process, it is reasonable to classify treatment as pretrial conference. Thus, counties with mandatory pretrial conference are treatment group, while counties without it is control group. (in this experiment, the researcher is estimating the effect of NOT having pretrial conference as mandatory.)

Second, is it valid to combine group A and group C into one sample group? Even though they all went through pretrial conferences, a variation within the group exists. For instance, if they opted pretrial conference when it is optional (group C), it could mean that both sides or at least one side prefer settlement to going to trial. However, within group A, there are people who

never wanted a pretrial conference and had to go through it as a mandatory process. The researchers did not consider an initial predisposition of the sample, and failed to properly control for it. It is not correct to combine these two groups only because they went through pretrial conference.

Third, it is possible that failure of settlement through pretrial conference can result in a rather longer and more painful trial than a trial without pretrial conference. After all, they reached trial since they could not find a more amicable way to conclude. Also, we do not know about the nature of cases. Perhaps Group B went to trial because they thought it was a simple winning case.

Finally, is the assumption that pretrial conference reduces the time of trial valid one? Once at trial, it might not matter whether there was a pretrial conference, because there is no way to return anyway. Maybe observational data about pretrial conferences and reductions in trial time do not have any causal relationship but rather some coincidental relationship.

A better study about the issue would be an experiment to compare a group given mandatory pretrial conference with a group that cannot have an opportunity for pretrial conference under any condition.

#### **Question 4.**

The principal problem here is that there is no pre-treatment group against which we can compare. The numbers cited in the survey might be higher or lower than prior to changes in the mental health services. There is no control group (no treatment) either, which might account for national trending and unusual current events such as September 11<sup>th</sup>.

Beyond that, without a confidence interval or other measure of variance, it is not possible to determine if even the averages cited are different from each other.

#### **Question 5.**

This is a sampling question. Survey results (especially election polls) can vary according to how samples were selected. And remember, journalism is not neutral! For example, Voter.com has conservative tendency, therefore those who visited the web site and were selected as a sample tend to be conservative as well. Thus, it slightly overestimated Bush's winning.

Also, there could be wording effects. We do not know how the questions were worded when the surveys were done. For example, asking, "For whom are you voting for president?" and

"Who do you think will win the election?" can result in different answers from the same respondent.