Lab Activities for an Introductory Statistics Course
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Abstract:
Come test and review a selection of activities that synthesize materials available in numerous locations on the internet with hands-on exercises that give students the opportunity to apply statistical concepts in a collaborative setting. The intent is to guide students step-by-step through activities that lead them to a deeper understanding of statistical concepts and force them to face common misconceptions.

Details:
Instructional goals in introductory statistics education are changing to emphasize statistical reasoning skills and deemphasize calculations (http://www.amstat.org/publications/jse/v5n3/chance.html). The trends are using computers, using real data, collaborative learning, and written presentation (Holcomb and Ruffer, (2000) "Using a Term-Long Project Sequence in Introductory Statistics," The American Statistician, Vol. 54). The American Statistical Association's curriculum guidelines for undergraduate programs in statistical sciences states "Undergraduate statistics programs should emphasize concepts and tools for working with data and provide experience in designing data collection and in analyzing real data…The detailed statistical content may vary, and may be accompanied by varying levels of study in computing, mathematics, and a field of application" (http://www.amstat.org/education/Curriculum_Guidelines.html). Further, statistics education research has found that "…statistical ideas are often misunderstood by students and professionals. In order to develop better statistical reasoning, students need to first construct a deeper understanding of fundamental concepts." And that "An activity that asked students to test their predictions and confront their misconceptions was found to be more effective than one based on guided discovery" (delMas, *Journal of Statistics Education* v.7, n.3, 1999).

A multitude of materials are publicly available online, such as java applets and data sets, that are intended to improve students' understanding of statistics. Until recently, these resources were not easy to find as they are not centrally located. Thankfully, individuals such as Professor Robin Locke and organizations such as CAUSE have organized and shared them with statistics educators. What remained for me was to create materials for my students that use these wonderful resources. I set out to build a collection of hands-on activities, many around java applets, with the following goals:

- to better students' understanding of the topics covered in class
- to help correct common misconceptions about statistical concepts
- to involve students with minimal guidance from the instructor
- to incorporate the latest research in the best practices in statistics education

The activities that I designed are currently being used in an introductory business statistics course. The class meets 3 hours per week in a "regular" classroom and once a week in a computer lab, which is where the activities are done. Students work in groups. I also envision the activities being used in a distance learning environment and/or as out-of-class exercises for the more independent learner.

Preliminary analysis suggests that the labs are generally successful in meeting the goals I had set for them. While I was initially concerned that the level of computer skills necessary to complete the labs may be too challenging, 60% of the students rated the skill level necessary as "rather basic" and the other 40% deemed it "at about the right skill level." The first run through the labs brought to my attention some places for me to clarify the instructions. The activities will continue to evolve and improve as more students work through them. All students (100%, n = 10) strongly agreed or agreed that the labs were generally helpful in bettering their understanding of the topic covered in class and 90% strongly agreed or agreed that the labs were generally helpful in correcting misconceptions (e.g. the mean is always the best measure of average and correlation means causation). Results of the final exam would somewhat contradict some of the students' assertions on misconceptions as 25% (3 out of 12) incorrectly answered that the correlation shown in the exam question proved that one variable caused the other to happen. A similar question was given on the final exam the previous quarter (autumn 2004) to students in the business statistics sequence without the lab component. Sixteen out of 29, or about 55%, answered incorrectly. This may suggest that the labs are successful in bettering students' understanding but I am cautious in considering this first class to be representative either of future students who will take the course or of past students who took the business statistics sequence without a lab component because this first class is much smaller than usual (12 versus about 30) and because this course was offered as a trailer in a program that is in the process of being placed in another college. Further assessment is necessary.

I welcome your suggestions for further assessment of the lab activities and on improving them. Please contact me with your comments.

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