HANDS-ON ACTIVITIES TO INTRODUCE RANDOMIZATION METHODS AND HYPOTHESES TESTING

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INTRODUCTION

Including the randomization test and bootstrapping in an introductory statistics courses makes possible to introduce statistical inference early in the semester. The use of the computer is necessary to teach those topics, however the student may not understand right away what the computer is doing. To have a concrete hands-on experience using manipulatives, previous to the use of the computer, facilitates the understanding of the randomization method under study. The topic of hypotheses testing can also be introduced with hands-on activities. This poster describes 3 activities, one to introduce each one of the following topics: randomization test, bootstrapping and test of hypothesis about a proportion. We have been successfully using those activities in introductory statistics courses for biology majors. The only materials needed are plastic chips and a marker. After each one of the two first hands-on activities is done in class, a program written in R is given to the students in order to do a larger number of randomizations. The program mimics the hands-on activities. The poster will present pictures of the materials and the different steps in the realization of the activities

ACTIVITY 1: RANDOMIZATION TEST TO COMPARE TWO GROUPS

The values of the response variable for the subjects in each one of two groups (experimental and control) is given to the students. Students work in pairs. They write the values in plastic chips, one color for each group (experimental and control). Each team has the complete data set. The mean of each group is calculated, as well as the difference of means which is marked on an axis on the board. Each team mixes the chips and randomly re-groups them in two groups, the values of the difference of means for each pair of random re-groupings is marked on the board. Students compare the difference for the random re-groupings with the difference between the treatment and control groups. The program is then introduced to do a large number of random re-groupings and count the number of times in which the difference of the random groups is equal or different than the original difference. A decision with respect to the null hypotheses is made.

ACTIVITY 2: BOOTSTRAPPING

A random sample is selected, the observations written in one color plastic chips. Each team of students has a complete set of chips, and selects a random sample with replacement of the same size of the original sample and calculates its mean. We write the means of the bootstrap samples in the board. The need for more bootstrap samples is discussed and the program is introduced.

ACTIVITY 3: TESTING Ho: $p = 0.5$

Two color plastic chips are used. The null hypothesis is that both colors have the same probability. Each student tosses his/her chip a certain number n of times. The binomial table is used to arrive at a conclusion about Ho for that particular chip. Activities with variations in n and p_o are suggested.

CONCLUSION:

The use of hands-on activities to introduce topics of statistical inference to first time students of statistics helps the students to understand the nature of the procedure that later they will see performed by the computer. Doing first the activities and then using programs that mimic the hands-on activities facilitates the understanding of the methods. Students are able to explain better in their own words, both the randomization test and bootstrapping, when these activities are used as compared when only software was used.