36-303: Sampling, Surveys & Society
HW01: Due Thursday Feb 4, 2008 in class
Please turn in HW on paper – much easier for the TA to grade!

Reminders:

- Things to turn in:
  - Due Next Tues: Team Assig. I.2 (revised two project proposals, using feedback emailed from me)
  - Due Next Thurs: This assignment
- Things to read:
  - Done already: Groves Ch 1, 2
  - This week:
    - Groves, Ch 5
    - Groves, Ch 11 (pp 345-358)
    - Groves, Ch 4 (pp 93-102)
  - Use as a reference: Lohr, Appendix B
- Clear, careful writing and interpretation of results is an important part of both weekly homeworks and the projects. *I always expect neatly typed or neatly handwritten work.*
- Always be judicious about including computer output and graphs: show enough that we can clearly see what you are doing, but not so much that we will get lost or bored leafing through your work!
- Mostly homeworks will be submitted on paper in class.

Exercises to Turn In (there are 4 excercises):

1. In 2008 Hart Research Associates, a public opinion survey organization, conducted a survey of American high school students for the Horatio Algier foundation. The results were reported in a document entitled "The State of Our Nation's Youth."
   (a) Find the report and/or homepage for this survey on the web, and fill out, as completely as possible, a table like Tables 1.1–1.6 of the Groves text, for this survey. You may (or may not) need to find additional web pages to get the information you need.
   (b) Please comment on any items in your table that would make it difficult to understand or believe the results of the survey (e.g. you couldn't get the information, or the information you got worries you in some way). *If you are happy with all the information in your table, just say that.*
   (c) The survey gives an overall 95% margin of error for the results. Find it, report it, and show that the method of calculating margin of error that we did in class produces approximately the same margin of error.

2. In 2009, Hart Research Associates conducted a survey of US Employers for the Association of American Colleges and Universities' LEAP[1] program, entitled "Raising the Bar: Employers' Views on College Learning in the Wake of the Economic Downturn". Re-do question #1 (all three parts!) for this survey.

3. Consider a set of n trials involving independent and identically distributed random variables $X_1, X_2, \ldots, X_n$, where the outcome of 1 corresponds to success and the outcome of 0 corresponds to failure, and the probability of success on each trial is p.

   (a) Show that $E(X_i) = p$, and $\text{Var}(X_i) = p(1-p)$ for $i = 1, 2, \ldots, n$.

   (b) Let $Y = X_1 + X_2 + \ldots + X_n$. Show that $E(Y) = np$, and $\text{Var}(Y) = np(1-p)$.

   (c) Let $\hat{p} = Y/n$. Show that $E(\hat{p}) = p$, and $\text{Var}(\hat{p}) = p(1-p)/n$.

4. We say that two discrete random variables are *independent* if $P[X = x, Y = y] = P[X = x] \times P[Y = y]$ for all specific values x and y that X and Y could be.

   (a) The table below shows the distribution for two random variables X abd Y. For example, $P[X = 1, Y = 3] = 3/8$.

x	y	$P[X = x, Y = y]$
1	4	$\frac{1}{8}$
1	3	$\frac{3}{8}$
2	4	$\frac{3}{8}$
2	3	$\frac{1}{8}$

   Use the information in the table to show whether X and Y are independent, or not.

   (b) For any two discrete random variables X and Y (not necessarily the ones in part (a)), show that **If** X and Y are independent, **then** $P[X = x | Y = y] = P[X = x]$, for any specific x and y that X and Y could be.

[1]Liberal Education and America's Promise