STAT 240 Homework 1

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Question 1. Consider a box that contains 5 "1" tickets and 7 "0" tickets. Consider drawing 6 tickets from this box at random with replacement. Let $X_1, X_2, ..., X_6$ denote the 6 numbers you observe. Let $\bar{X}$ denote the average of the draws.

a) What is $E[\bar{X}]$?

b) What is $SE[\bar{X}]$? (R hint: Be careful whether the function "sd" divides by the square root of n or $n-1$)

c) Use **R** to simulate 100,000 values of $\bar{X}$. Produce a histogram of these values. (R hint: Use the function sample).

d) Let $z_1 = E[\bar{X}] + SE[\bar{X}]$, $z_2 = E[\bar{X}] + 2 \times SE[\bar{X}]$, etc. For $z_1, ..., z_4$ calculate $P(\bar{X} > z_i)$ in three ways:

- Exactly, using the binomial distribution. (Hint: It will be easier to work with the sample sum than the sample average. R hint: Use function pbinom)

- Estimated using the values from part (c)

- Using the normal approximation. Use the continuity correction. (R hint: pnorm)

Do the same for $z_{-4}, ..., z_{-1}$ but calcualte $P(\bar{X} < z_i)$ instead of $P(\bar{X} > z_i)$. Make a table of your results and comment briefly
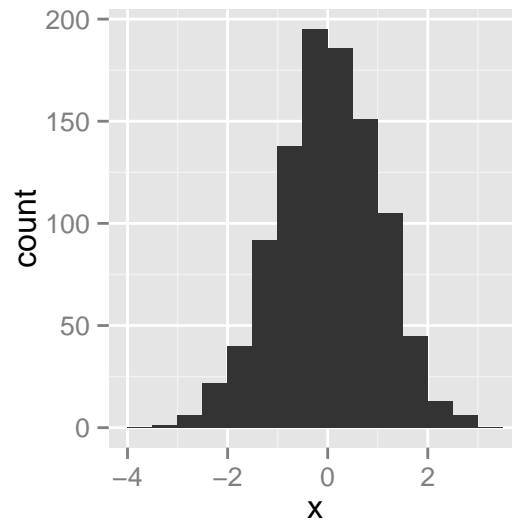
Figure 1: Some silly histogram example

Repeat (a)-(d), this time sampling without replacement instead of with replacement. Use the hypergeometric distirbution instead fo the binomial distribuion (R hint: phyper)