HW due a start of class 8-2-10.

1. Let $X$ = the number of tosses to obtain the first head.
   
   a. Guess $\mu = E \ X$ (it is intuitive)

   b. Can you guess $\sigma$?

   c. Let $x_1$ denote the number of tosses you have to make to get the first head. Repeat the experiment to get $x_2$ (the number of tosses you have to make to get the first head the second time you try the experiment). Do this 30 times getting $x_1, \ldots, x_{30}$. Record the results (number of tosses required for each of 30 replications of "tossing until the first head."

   d. From your sample of $n = 30$ give

      $\bar{x}$ (sample mean), an estimate of $\mu$

      $s$, your estimate of $\sigma$

      $\frac{s}{\sqrt{n}}$, your estimate of the standard deviation of $\bar{x}$

      MOE (margin of error for $\bar{x}$) = 1.96 $\frac{s}{\sqrt{n}}$
1. Let \( X \) = the number of tosses to obtain the first head.

   a. Guess \( m = \mathbb{E} X \) (it is intuitive)

   b. Can you guess \( s \)?

   c. Let \( x_1 \) denote the number of tosses you have to make to get the first head. Repeat the experiment to get \( x_2 \) (the number of tosses you have to make to get the first head the second time you try the experiment). Do this 30 times getting \( x_1, \ldots, x_{30} \). Record the results (number of tosses required for each of 30 replications of "tossing until the first head").

   d. From your sample of \( n = 30 \) give \( \bar{x} \) (sample mean), an estimate of \( m \)

      \( s \), your estimate of \( \sigma \),

      \[ \text{MOE (margin of error for } \bar{x} ) = 1.96 s \]

      \[ 95\% \text{ CI for } \mu \]

      If \( \mu \) is not in your interval then a "bad" event has occurred. What is the probability of this "bad" event?

      Around what fraction of the class should have an 80% t-CI containing \( \mu \)?

Prepare a histogram of your 30 numbers, does it look at all as though \( X \) is normal distributed?

2. Let \( X \) = the number of heads in 10 tosses of a coin. Although \( X \) is not normally distributed (it is binomial) the distribution is not far from normal with mean \( np \), and standard deviation \( \sqrt{np(1-p)} \). For \( n = 3 \) times toss a coin 10 times recording the number of heads \( x_1, x_2, x_3 \) in each of the three experiments.

   From your sample of \( n = 3 \) give

   \[ \bar{x} \] (sample mean), an estimate of \( \mu \)

   \[ s \], your estimate of \( \sigma \)
1. Let $X$ = the number of tosses to obtain the first head.

   a. Guess $m = E(X)$ (it is intuitive)

   b. Can you guess $s$?

   c. Let $x_1$ denote the number of tosses you have to make to get the first head. Repeat the experiment to get $x_2$ (the number of tosses you have to make to get the first head the second time you try the experiment). Do this 30 times getting $x_1, \ldots, x_{30}$. Record the results (number of tosses required for each of 30 replications of "tossing until the first head.")

   d. From your sample of $n = 30$ give $\bar{x}$ (sample mean), an estimate of $m$, your estimate of $s$, your estimate of the standard deviation of $x$. MOE (margin of error for $\bar{x}$) = $t_{0.025} \frac{s}{\sqrt{n}}$

2. Let $X$ = the number of heads in 10 tosses of a coin. Although $X$ is not normally distributed (it is binomial) the distribution is not far from normal with mean $np$, and standard deviation $\sqrt{np(1-p)}$.

   For $n = 3$ times toss a coin 10 times recording the number of heads $x_1, x_2, x_3$ in each of the three experiments.

   From your sample of $n = 3$ give $\bar{x}$ (sample mean), an estimate of $m$, your estimate of $s$, your estimate of the standard deviation of $x$. MOE (margin of error for $\bar{x}$) = $t_{0.025} \frac{s}{\sqrt{n}}$ 80% t-based CI for $\mu$

   If $\mu$ is not in your interval then a "bad" event has occurred. What is the probability of this "bad" event?

   Around what fraction of the class should have an 80% t-Cl containing $\mu$?

3. A 95% z-Cl for $\mu$ based on a large sample selected with replacement from a population is given as [3.884, 3.917].

   MOE

   Interval for 68% confidence

   $\bar{x}$

   95% z-Cl if instead the sampling is without replacement, population size $N = 1000$ and sample size $n = 100$. 