Probability for means in a simple random sample

- quantitative variable X with a value for each item/individual in a population
- distribution of X for the population will have a mean $\mu_X = \mu$ and a standard deviation $\sigma_X = \sigma$
- select SRS of size n
  - measure value of X for each item/individual and compute sample mean $\bar{x}$
  - consider $\bar{x}$ as a random variable measured on the outcome of the random process that is selecting a SRS of size n
- can compute $\mu_{\bar{x}} = \mu$ and $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$
  - having $\mu_{\bar{x}} = \mu$ means $\bar{x}$ is an unbiased estimator of σ
  - having $\sigma_{\bar{x}} = \sigma/\sqrt{n}$ means we can reduce variability in $\bar{x}$ by increasing sample size
- probability model for the continuous random variable $\bar{x}$
  - from simulations, conjecture that if X has a normal distribution, then $\bar{x}$ has a normal distribution for any sample size
  - from simulations, conjecture that if X has any distribution, then the distribution for $\bar{x}$ gets closer to a normal distribution as the sample size gets larger (Central Limit Theorem)