REFLECTIONS 11/15/2011 STAT 4/6070

Discrete Random Variables

- Finite number of values
- Displayed in histograms
- Mean/Expected Value: (Weighted Average): $\mu = \sum x \cdot P(x)$
- To be a valid Probability Distribution:
  - $0 \le P(x) \le 1$
  - $\sum P(x) = 1$

GPS/CCSS: MM3D1

Binomial Distribution

1) categorical variables
2) "Success" depends on how we "define" the random variable
3) p = probability of success
4) (1-p) = probability of failure
5) Assumes independent trials (p stays constant)
6) $\mu = np$ = mean
7) $s = \sqrt{np(1-p)}$ = s.d.
8) easily calculated probabilities
9) $P(X = x) = \binom{n}{x} p^x (1-p)^{n-x} = \left(\frac{n!}{x!(n-x)!}\right) p^x (1-p)^{n-x}$
10) can be approximated well by the normal distribution when # of failure and success is at least 15
11) "Success" does not always mean something "positive" or "good"
12) Each trial has two outcomes
13) Fixed number of trials, *n*.

GPS/CCSS: N/A

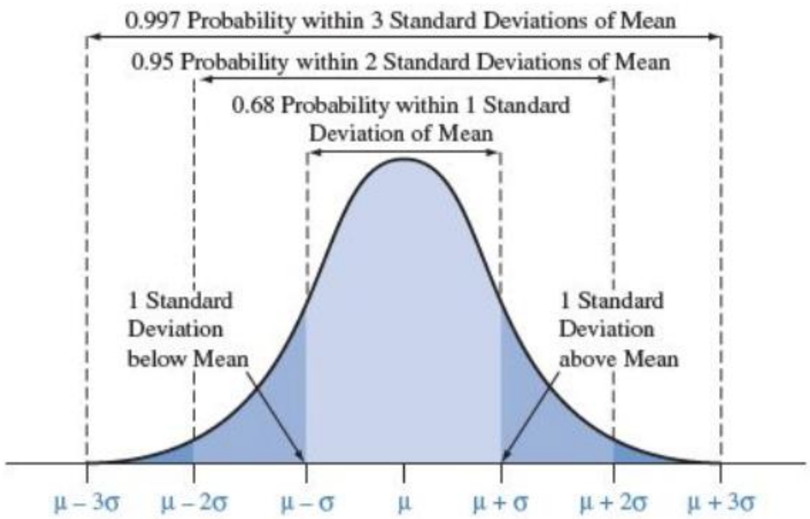
Geometric Distribution

- X = number of trials until the first success; discrete random variable
- $P(X = x) = p(1-p)^{x-1}$ where x = 1, 2, ... and p = prob. of a success
- $\mu = 1/p$
- Special case of the negative binomial distribution.

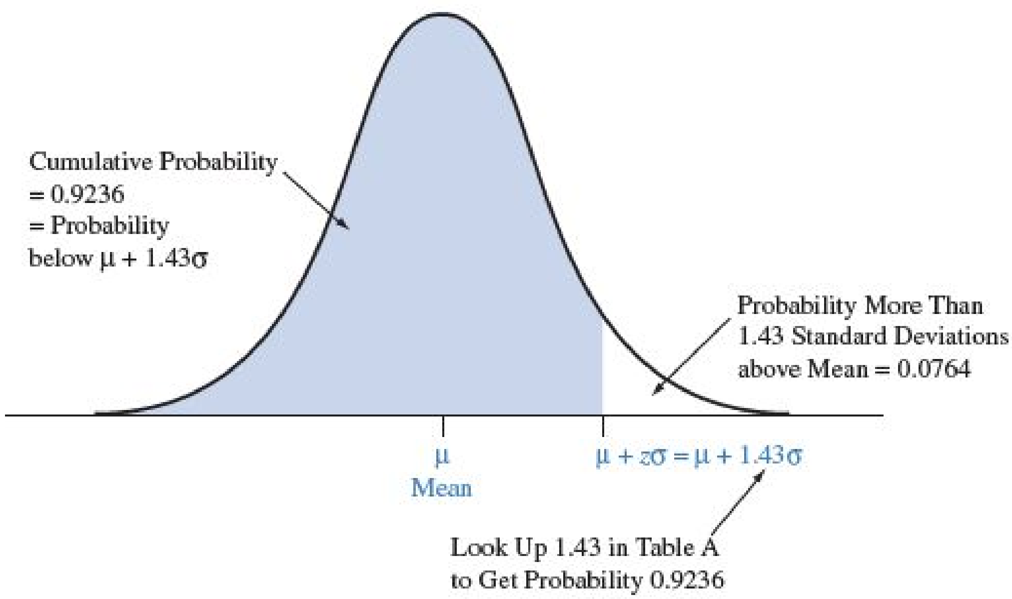
GPS/CCSS: N/A

<u>Normal Distribution (Continuous R. Variable)</u>

- z-score probability
- Probability distribution → symmetric, bell-shaped graph
- Mean and Standard deviation parameters
- Empirical Rule (Image from our textbook, p. 280)



-
- Standard Normal Distribution → μ=0, σ=1
- Cumulative Probability: (Image from textbook, p 282.)



- Continuous random variable has possible values that form an interval
- Probability is between 0 and 1.

GPS/CCSS: MM2D1,MM3D2

Adding/Subtracting Two Independent Random Variables

- The sum of the means = mean of total $\mu_{x\pm y} = \mu_x \pm \mu_y$
- The square root of the sums of the squares of the standard deviations (of the parts) is the standard deviation of the total (or difference)

$$\sigma^2_{x+y} = \sigma^2_x + \sigma^2_y$$

$$\sigma^2_{x-y} = \sigma^2_x + \sigma^2_y$$

GPS/CCSS: MM3D1

Frequentist versus Bayesian Probability

FREQUENTIST	BAYESIAN
Long run relative frequency	Probability is evidence based – degree belief
Θ is fixed and unknown	Θ must be given a distribution
Θ never gets assigned probability	Θ has probability but no agreement on dist.

GPS/CCSS: N/A

Confidence Interval for a Proportion

Estimate ± margin of error → sample proportion ± z (standard error of sample proportion)

Contains a range of plausible values for the population proportion at a specified confidence level

If using 95% confidence level, in repeated sampling, if we build an interval using the above procedure, we expect 95% of the intervals to capture the population proportion.

GPS/CCSS: MM4D3