Concepts to Know #3

Math 141
7.4-7.6, Chapter 8

- Recall 7.1-7.3 information.
- **7.4 - Counting to find Probabilities**

  If S is uniform, then $P(E) = \frac{n(E)}{n(S)}$

- **7.5 - Conditional Probability and Independent Events**

  $P(A \mid B) = \frac{P(A \cap B)}{P(B)}$ if $P(B) \neq 0$

  Product Rule: $P(A \cap B) = P(A \mid B)P(B)$

  Independent Events - the outcome of one event does not affect the prob. of another event occurring

  $P(A \cap B) = P(A)P(B)$
  $P(A) = P(A \mid B)$
  $P(B) = P(B \mid A)$

  Know the difference between independent events and mutually exclusive events

- **7.6 - Bayes' Theorem**

  Use the conditional probability formula and use a tree to find the values you need; the probability of the path you want divided by the probability of all possible paths to the given outcome

  BE ABLE TO DRAW AND READ TREES!

- **8.1 - Distributions of Random Variables**

  Random Variable - a rule that assigns a number to each outcome of a chance exp.

  Categories of R.V.

  Finite Discrete - assumes a limited number of values which can all feasibly be written down

  Infinite Discrete - assumes infinitely many values that may be arranged in a sequence

  Continuous - assumes values over an interval of real numbers

  Histograms - graphical representation of a prob. dist. of a finite discrete r.v.

  Width of rectangles = 1
  Height = prob. of r.v. value
  Sum of areas of rect. = 1

- **8.2 - Expected Value**

  Average = Mean = $\overline{x} = \frac{x_1+x_2+\cdots+x_n}{n}$

  Expected Value = $E(X) = x_1p_1+x_2p_2+\cdots+x_np_n$

  Median = the middle number when the numbers are arranged numerically; Med on calc.

  Mode = the most frequently occurring value

  "Fair" games - $E(X) = 0$
  (X = net gain; no advantage to either party)

  Odds - ratio of whole numbers - "a to b"

  Odds in favor of $E = \frac{P(E)}{P(E^C)}$

  Odds against $E = \frac{P(E^C)}{P(E)}$

  If odds in favor of E are "a to b", then $P(E) = \frac{a}{a+b}$

- **8.3 - Variance and Standard Deviation**

  KNOW HOW TO USE "1-VAR STATS L_1, L_2" ON YOUR CALC!

  Standard deviation = σx
  Variance = $(\sigma x)^2$

  Understand what standard deviation/variance tells you about a set of data

- **8.4 - The Binomial Distribution**

  Know binomial experiment properties:

  Number of trials fixed
  Two outcomes (success or failure)
  Prob. of success in each trial is the same
  Independent trials

  Prob. of r successes: $P(X = r) = C(n,r)p^rq^{n-r}$ where p is the prob. of success, q is the prob. of failure, and n is the number of trials

  Know how to use your calculator functions:

  $P(X = r) = \mathit{binompdf}(n,p,r)$
  $P(0 \leq X \leq r) = \mathit{binomcdf}(n,p,r)$

  For the binomial r.v. X:

  $E(X) = np$
  $Var(X) = npq$
  $\sigma = \sqrt{npq}$

- **8.5 - The Normal Distribution**

  Properties of prob. density functions (p.d.f)

  Normal Curve properties:

  Peak at μ

  Symmetric with respect to $x = \mu$

  σ determines "flatness" of the curve

  Curve always above x-axis, extending indefinitely in both directions

  Area under the curve = 1

  68.27% of area within one std.dev. of the mean

  95.45% of area within two std. devs. of the mean

  99.73% of area within three std devs. of the mean

  Standard normal curve is normal curve with $\mu = 0, \sigma = 1$

  Standard normal random variable is Z.

  Know how and when to use your calculator functions:

  $P(a < X < b) = P(a \leq X \leq b)$
  $= P(a \leq X < b) = P(a < X \leq b)$
  $= normalcdf$(a,b,μ, σ)

  $a = invNorm$(total area to the left of a, μ, σ)

- **8.6 - Applications of the Normal Distribution**

  Finding probabilities and r.v. values with normally distributed data that is not "standard normal"

  Approximating binomial distributions with normal distributions