Probability Handout

Important Information

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$	Addition Rule
$P(A \cap B) = P(A) \cdot P(B)$	Independent Events
$P(A \cap B) = 0$	Mutually Exclusive Events
$P(B\|A) = P(A \cap B)/P(A)$	Conditional Probability
$P(A^C) = 1 - P(A)$	Complement Rule
$P([A \cup B]^C) = P(A^C \cap B^C)$	De Morgan's Law
$P([A \cap B]^C) = P(A^C \cup B^C)$	De Morgan's Law
The probability of any event E is such that	$0 \leq P(E) \leq 1$
The sum of the probabilities of the outcomes	in the sample space equals 1.
num of successes / num of possible outcomes	Classical Probability

Sum of Dice Table

+	**1**	**2**	**3**	**4**	**5**	**6**
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Uniform Distribution

$$P(a \leq X \leq x) = \frac{x-a}{b-a}$$
$$P(x \leq X \leq b) = \frac{b-x}{b-a}$$
a = left endpoint
b = right endpoint
$$\mu = \frac{a+b}{2}$$
$$\sigma^2 = \frac{(b-a)^2}{12}$$

Exponential Distribution

$$P(0 \leq X \leq x) = 1 - e^{-\lambda x}$$
$$P(X \geq x) = e^{-\lambda x}$$
x = time between events
$\mu = 1/\lambda$
$\sigma^2 = 1/\lambda^2$

Poisson Distribution

$$P(X = x) = \frac{e^{-\lambda}\lambda^x}{x!}$$
x = number of occurrences in an interval of time, area, etc.
$e = 2.71828$
$\mu = \lambda$
$\sigma^2 = \lambda$

Binomial Distribution

$$P(X = x) = {}_nC_x \cdot p^x q^{n-x}$$
n = number of trials
x = number of successes
p = probability of success
q = probability of failure
$\mu = np$
$\sigma^2 = npq$

Events are independent
Two possible outcomes
Set number of trials

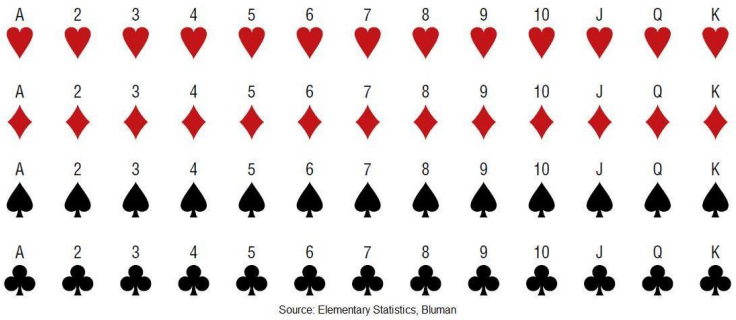
Important Formulas

$$n! = n(n-1)(n-2)\cdots 2 \cdot 1$$
$$0! = 1$$
$${}_nP_r = \frac{n!}{(n-r)!}$$
$${}_nC_r = \frac{n!}{r!(n-r)!}$$
$$\mu = E(X) = \sum xP(x)$$
$$\sigma^2 = E(X^2) - \mu^2 = \sum x^2 P(x) - \mu^2$$

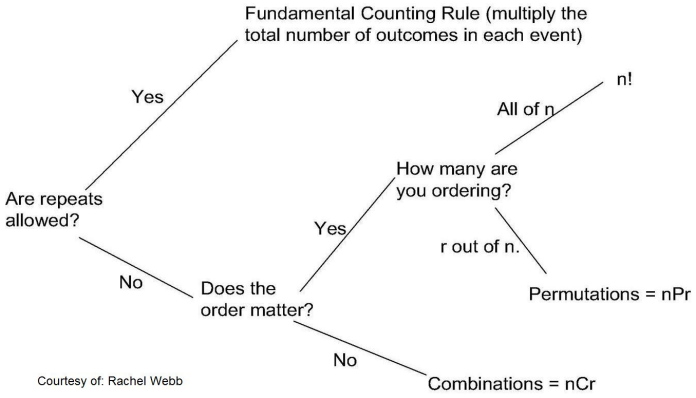
Hypergeometric Distribution

$$P(X = x) = \frac{{}_aC_x \cdot {}_bC_{n-x}}{{}_{a+b}C_n}$$
n = number of trials
x = number of successes
a = total number of successes
b = total number of failures
$$\mu = n\left(\frac{a}{a+b}\right)$$
$$\sigma^2 = n\left(\frac{a}{a+b}\right)\left(1 - \frac{a}{a+b}\right)\left(\frac{a+b-n}{a+b-1}\right)$$
Selection is done **without** replacement
Two types of objects

The Standard Deck of 52 Cards



Source: Elementary Statistics, Bluman



Courtesy of: Rachel Webb

Hypergeometric Distribution

$$\frac{\text{Number of Success/Type 1 in Population} \;C\; \text{Number of Success/Type 1 in Subgroup} \bullet \text{Number of Fail/Type 2 in Population} \;C\; \text{Number of Fail/Type 2 In Subgroup}}{\text{Number of Items in Population} \;C\; \text{Number of Items in Subgroup}}$$

Courtesy of Shawn Mehess

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