Unit 2 Review

Types of Probability :
1. Relative Frequency Approach (Experimental)
2. Classical Approach (Theoretical)
3. Subjective Probability

Law of Large Numbers

Given any event A , $0 \leq P(\text{A}) \leq 1$

Addition Rule : "OR" Events

$$P(\text{A or B}) = P(\text{A}) + P(\text{B}) - P(\text{A and B})$$

Multiplication Rule : "AND" Events

Dependent Events : $P(\text{A and B}) = P(\text{A}) \times P(\text{B} \mid \text{A})$

Independent Events : $P(\text{A and B}) = P(\text{A}) \times P(\text{B})$

Complementary Events : $P(\text{A}) = 1 - P(\overline{\text{A}})$

$P(\text{at least one}) = 1 - P(\text{none})$

Conditional Probability :

$P(\text{B} \mid \text{A})$ = probability of B if A has occurred.

$P(\text{B} \mid \text{A})$ = probability of B given that A has occurred.

$$P(\text{B} \mid \text{A}) = \frac{P(\text{A and B})}{P(\text{A})}$$

e.g. Given the table below, if we select one person at random, find…

	Yes	No	Not sure	Total
Men	90	7	3	100
Women	88	7	5	100
Total	178	14	8	200

P(Woman and No) = $\frac{7}{200}$ = 0.035

P(Woman or Yes) = P(Woman) + P(Yes) – P(Woman and Yes)

$$= \frac{100}{200} + \frac{178}{200} - \frac{88}{200} = \frac{190}{200} = 0.95$$

P(Man | Not sure) = $\frac{3}{8}$ = 0.375

P(Yes | Man) = $\frac{90}{100}$ = 0.90

Counting Rules (count how many outcomes are possible)

Choose a few from many

If order/sequence matters : Permutations Rule $_nP_r = \frac{n!}{(n-r)!}$

If it does NOT matter : Combinations Rule $_nC_r = \frac{n!}{(n-r)!r!}$

Arranging an order/sequence of all items in a collection

If all are different : Factorial Rule = $n!$

If the items fall into groups : Special Permutations Rule = $\frac{n!}{n_1!n_2!\ldots}$

Any other situation

Fundamental Counting Rule = $m \times n \times \ldots$

e.g. A bag contains 10 M&M candies (3 red, 2 brown, and 5 green).

In how many different orders could we select 4 of them?
Order matters, $_{10}P_4$ = 5040

How many sets of 4 could we select from the bag?
Order does not matter, $_{10}C_4$ = 210

If we eat all 10 by color, how many different ways could we do it?
Grouped by color, Special permutations rule = $\frac{10!}{3!2!5!}$ = 2520

If we eat all 10, how many different ways could we do it?
Assuming we can tell them apart, Factorial rule = 10! = 3,628,800

A second bag contains 12 Skittles candies. If we take one M&M and one Skittle, how many different pairs could we get?
Fundamental Counting rule = 10×12 = 120
(This assumes we can tell each piece of candy apart)