

# PROBABILITY NOTES

**Set** – a collection of objects

**Elements** – members of set... they are enclosed with braces { }

**Finite** – there is a certain number of elements in a set

**Infinite** – number of elements never ends

$\in$  = *is an element of a set*

$\notin$  = *is not an element of a set*

$\cup$  = *union of two sets*

**Empirical probability** – probability that is observed

**Theoretical probability** – probability that is math based

**Conditional probability** – already know result of first event, what will probability of second event be

**Probability theory** attempts to describe the predictable long-run patterns of random processes.

**Experiment in probability** is a controlled operation that yields a set of results

**Outcomes** – possible results

**Event** – a subset of outcomes

**Sample space** – a list of all possible outcomes  $S = \{\text{list of outcomes}\}$

**Theoretical Probability** =  $P(E) = \frac{\text{number of ways an event can occur}}{\text{total number of outcomes}}$

Laws of Probability:

1. It happens or else it doesn't. The probability of an event happening added the probability of it not happening is always 1.  
 **$P(A \text{ happens}) + P(A \text{ doesn't happen}) = 1$**
2. Exclusivity. If A and B can't both happen at the same time (in which case we say that A and B are mutually exclusive), then  $P(\text{either A or B happens}) =$   
 **$P(A \text{ happens}) + P(B \text{ happens})$**
3. Independence. If B is no more or less likely to happen when A happens than when A doesn't (in which case we say that A and B are independent), then  
 **$P(A \text{ and B both happen}) = P(A \text{ happens}) * P(B \text{ happens})$**
4. Sub-Events. If whenever A happens B must also happen, then B must be at least as likely as A, so  **$P(A \text{ happens}) \leq P(B \text{ happens})$**

Odds are expressed as a ratio 1:5

Probability is expressed as a fraction  $\frac{1}{5}$

Odds in favor of event = event occurs:event doesn't occur

Odds against an event = event does not occur:event occurs

$$4:48 \text{ --- } \frac{4}{52}$$

Probability of rain is 30% how would you express odds?

$$\frac{30}{100} = \text{probability \& Odds} = 30:70 \text{ or } 3:7$$

Odds of dying from lightning strike is 1 in 126,158 or 1:126,158

$$\text{Probability would be } \frac{1}{126,159}$$

## Tree Diagrams

**Sample space** - a list of all possible outcomes

