3.1 Basic Concepts of Probability Assign:

A Probability Experiment is an action, or trial through which specific results (counts or measurements) are obtained.

An Outcome is the result of a single trial in a probability experiment.

An Event consists of one or mre results or outcomes.

A Simple a event is an event that consists of a single outcome that cannot be broken down further.

Decide whether the event is a simple event:

Ex #1. For quality control, you randomly select a computer chip from a batch that has been manufactured that day. The event is selecting a specific defect chip.

Ex #2. You roll a six-sided die. The event is rolling at least a 4.

A Sample Space is the set of all possible outcomes for a probability experiment.

Ex. Write the sample space for tossing a coin and rolling a die.

There are 3 types of probability.

1. Classical or Theoretical Probability is used only for equally likely outcomes.

Formula: $P(E) = \dfrac{\text{number of ways E can occur}}{\text{Total number of outcomes (sample space)}}$

Ex #1. A multiple choice question has 4 choices. If you make a random guess, what is the *P* that your answer is wrong?

Ex #2. What is the *P* of rolling a 2?

Ex #3. What is the *P* of rolling a number less than 3?

Ex #4. What is the *P* of rolling a number less than 9?

Ex #5. Find the *P* that a couple with 3 children will have exactly 2 boys.

Probability Values can never be negative and must be ≥ 0 or ≤ 1.

If the *P(E)* = 1 , then the event is certain to happen.

If the *P(E)* = 0 , then the event cannot happen.

1	certain
	likely
.5	50/50 chance
	unlikely
0	impossible

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2. Empirical Probability is based on observations/experiments.

Formula: $P(E) = \frac{\text{frequency of event } E}{\text{total frequency}} = \frac{f}{n}$

Ex. An insurance company determines that in every 100 claims, 4 are fraudulent. What is the *P* that the next claim is fraudulent?

Law of Large Numbers states that as an experiment is repeated over and over, the empirical probability of an event approaches the theoretical probability.

3. Subject Probability --- the probabilities that result from intuition, educated guesses, or estimates based on knowledge or relevant circumstances. There is NO formula for this. An example would be a doctor making a prediction about a patient.

State the type of probability indicated by each.

Ex #1. *P* of your phone ringing during is .50.

Ex #2. *P* that a voter chosen at random will vote Republican is 0.45.

Ex #3. *P* of winning a 1000-ticket raffle with each ticket having a 1/1000 chance of being selected.

Complement of an event E is the set of all outcomes in the sample space that are not included in event E.

The complement of E is written E' or $\bar{E}$.

$P(E) + P(\bar{E}) = 1$ so $P(\bar{E}) = 1 - P(E)$

Ex #1. If Q = a defective radio, then $\bar{Q}$ =

Ex #2. If B = the roll of the die is at least 5, then $\bar{B}$ =

Ex #3. If $P(E) = .024$, then $\bar{P}$ =

Ex #4. P of drawing a green ball is 0.35. What is the P of not drawing a green ball?

'Odds' expresses the likelihood of something happening.

Odds against = $\frac{P(\bar{E})}{P(E)}$ Odds in favor = $\frac{P(E)}{P(\bar{E})}$

Ex. If $P(E) = \frac{2}{5}$ and $P(\bar{E}) = \frac{3}{5}$, find the odds against and the odds in favor.