

## RECAP HANDOUT I

**DEFINITIONS:** *RANDOM:* non predictable. *Experiment:* observation of a random, repeatable happening. *Outcome:* the results of an experiment. *Sample Space:* the set of all possible outcomes. *Event:* any subset of the s.s.

**COUNTING PRINCIPAL:** If there are  $m$  ways to perform a task and for each of those ways there are  $n$  ways to perform a second task, then there are  $mn$  ways to perform a sequence of the two tasks. If a sequence of more than two tasks is to be performed, then the principle may be applied as many times as is necessary.

**DEFINITIONS:** To each outcome  $x$  in a discrete sample space  $S$  we assign a unique number “ $p$  of  $x$ ,” written  $p(x)$ , called the *PROBABILITY of  $x$*  with the property that  $0 \leq p(x) \leq 1$  and the sum of the probabilities of all the outcomes in  $S$  is 1. Now let  $A$  be any event in  $S$ . If  $A$  is empty (no outcomes in  $A$ ), then  $p(A) = 0$ ; if not, then  $p(A)$  is the sum of the probabilities of all the outcomes in  $A$ . Note that  $p(S) = 1$  and that  $p(A^c) = 1 - p(A)$ . A sample space  $S$  with a probability  $p$  is called a *PROBABILITY SPACE*.

**IMPORTANT:** If every outcome in  $S$  has the same probability, then  $p$  is called a *UNIFORM PROBABILITY*. In this case, each outcome has probability  $1/(\text{the total number of outcomes in } S)$  and for any event  $A$ ,  $p(A) = (\text{the number of outcomes in } A)/(\text{the total number of outcomes in } S)$ .

### SOLVING A PROBABILITY PROBLEM:

- (1) State the problem in precise language (not open to extraneous interpretations.)
- (2) Create a sample space that reflects the reality of the situation.
- (3) Assign a probability in a realistic way (based on information that you do know not on what you don't know.)
- (4) Compute the probability of the event in question.

**EXAMPLES:** (1) A coin is tossed twice. What is the probability of getting (a) two heads (b) one head and one tail (c) three heads?

**(2) Among three children in a family, what is the probability of there being (a) at least two girls (b) two girls or two boys?**

**(3) On the single roll of a pair of dice, what is the probability of (a) rolling a 4 (b) rolling a 9 or 10 (c) having one die show a 2 or having the sum of both dice be even?**

**(4) Given 16 numbers from 1 to 100 chosen at random, what is the probability that at least two are the same?**

**(5) Three Door Problem:**

- (a) The car is behind one of the doors. To set the scene, we suppose it is behind door #1.**
- (b) You select a door at random (say that you pick a number 1, 2, or 3 from a hat.)**
- (c) The MC opens a “peanut” door.**
- (d) You switch to the other remaining door.**
- (e) Create a realistic sample space and assign realistic probabilities to the outcomes.**
- (f) Compute the probability that you won.**