12.5 TREE DIAGRAMS

The Counting Principle is used to determine the number of outcomes of an experiment.
Tree diagrams can be used to determine all the possible outcomes of an experiment.

Counting Principle: 6
If a first experiment can be performed in *M* distinct ways and another experiment can be performed in *N* distinct ways, then the two experiments in that specific order can be performed in $M \cdot N$ ways. 2

$6 \cdot 2 = 12$

Sample Space = a list of all the possible outcomes of an experiment

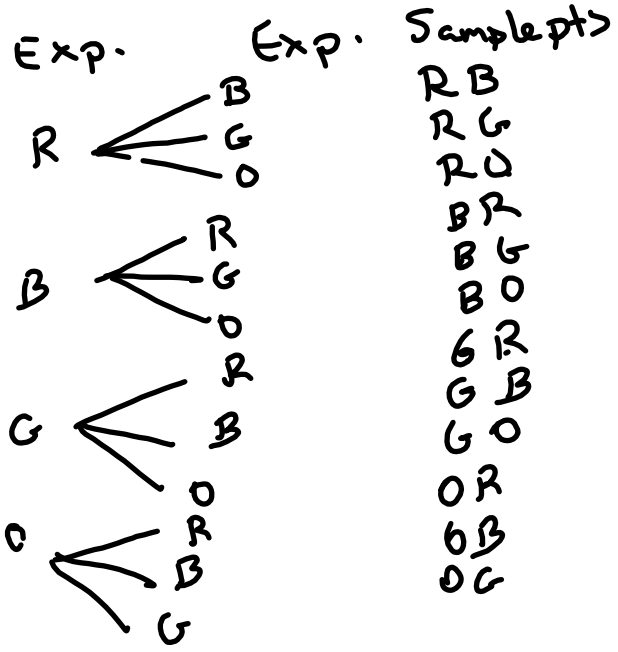
Sample point = each individual outcome in the sample space

Tree diagrams = useful illustration to help determine all the possible outcomes

Ex : Selecting Balls without replacement
1. Two balls are selected without replacement (item cannot be selected more than once) from a bag that contains one red, blue, green, and orange ball.

a) Use the counting principle to determine the number of points.
4 choices for the first ball and 3 choices for the second = $4 \cdot 3 = 12$

b) Construct a tree diagram to list the sample space.



c) Determine the probability that one orange ball is selected.

$\frac{6}{12} = \frac{1}{2}$

d) Determine the probability that a green ball followed by a red ball is selected.

$\frac{1}{12}$

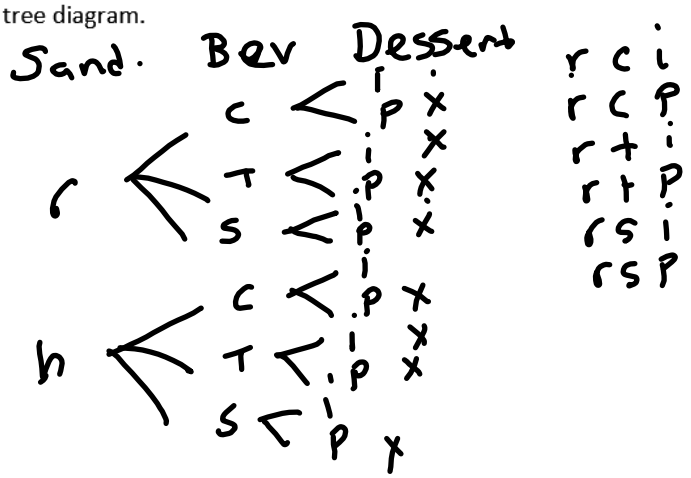
Ex: Lunch Choices

2. At Theresa's Restaurant, each lunch special consists of a sandwich, a beverage, and a dessert. The sandwich choices are roast beef (r) or ham (h). The beverage choices are coffee (c), tea (t), or soda (s). The dessert choices are ice cream (i) or apple pie (p).

a) Use the counting principle to determine the number of different lunch specials offered.

2 choices for sandwich, 3 choices for beverage, 2 choices for dessert = $2 \times 3 \times 2 = 12$

b) Construct a tree diagram.



c) If a customer randomly selects one of the lunch specials, determine the probability that both a roast beef sandwich and ice cream are selected.

$\frac{3}{12} = \frac{1}{4}$

d) Determine the probability that neither tea nor apple pie is selected.

$\frac{4}{12} = \frac{1}{3}$

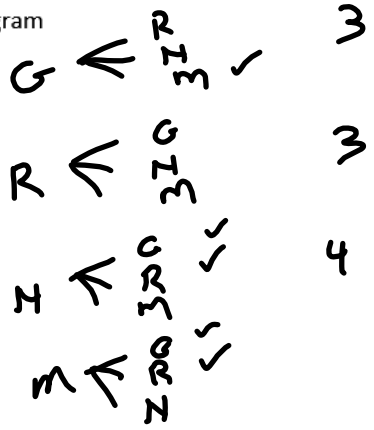
Ex: Selecting Ticket Winners

3. A radio station has two tickets to give away to a Beyonce concert. It held a contest and narrowed the possible recipients down to four people: Geena (G), Rachel (R), Nick (N), and Matt (M). The names of two of these four people will be selected at random from a hat and the two people selected will be awarded the tickets.

a) Use the counting principle to determine the number of different ways two of the four people can be picked. $4 \times 3 = 12$

1st 2nd

b) Construct a Tree Diagram



c) P(neither Rachel nor Nick is selected) = $\frac{2}{12} = \frac{1}{6}$

d) P(at least one girl is selected) = $\frac{10}{12} = \frac{5}{6}$

*** If E is a specific event, either E happens at least one time or it does not happen at all. Thus,**

P(E happening at least once) + P(E does not happen) = 1

P(event happening at least once) = 1 – P(event does not happen)