MDM4U **Basic Probability Concepts** Date: _____

Probability
one of the major branches of modern math that attempts to predict only what might happen. Probability is called "Math of chance". It is measured or estimated on a scale of **0 to 1**.

Probability of **0** means the probability of an event to happen is impossible.
Probability of **1** means the probability of an event to happen is certain

Event
an experiment or a possible observation.

Simple event
one that consists of exactly one outcome (ex. Rolling a 6 on a die)

Event space
the collection of all possible outcomes that make up the event (ex. Roll 2,4 or 6)

Trial
one repetition of an experiment.

Outcomes
all possible results.

Sample space
the collection of all possible outcomes of the experiment (ex. Roll 1,2,3,4,5 or 6)

Theoretical probability
if all events are equally likely, it's the ratio of the number of outcomes in the event to total number of outcomes (ex. P(even roll) = 3/6 = 1/2)

Empirical or experimental probability – is found using:

$$P(A) = \frac{\text{\# of times the desired event occurred}}{\text{number of trials}}$$

Subjective probability is an estimate of likelihood based on intuition and experience.

Probability of an Event

For an event A, **P(A) = n(A) / n(S)** where n represents the number of outcomes and S is the **sample space**.

Example: Drawing a "face card" from a deck of cards

$$P(\text{face card}) = \frac{\text{number of face cards}}{\text{total number of card}} = \frac{12}{52} = \frac{3}{13}$$

Probability of a Complementary Event

For an event A, the complement A' consists of all the outcomes in the sample space that aren't part of the set A. Additionally, **P(A') = 1 – P(A)**

Example: Not drawing a queen from a deck.

P(not a queen) = 1 – P(queen) = 1 – 4/52 = 48/52 = 12/13

Example: What is the probability of tossing 3 heads in 4 tosses?

S is all possible outcomes – 4 tosses = 16 possible outcomes

A is all possible 3 head combos – HHHT, HHTH, HTHH, THHH

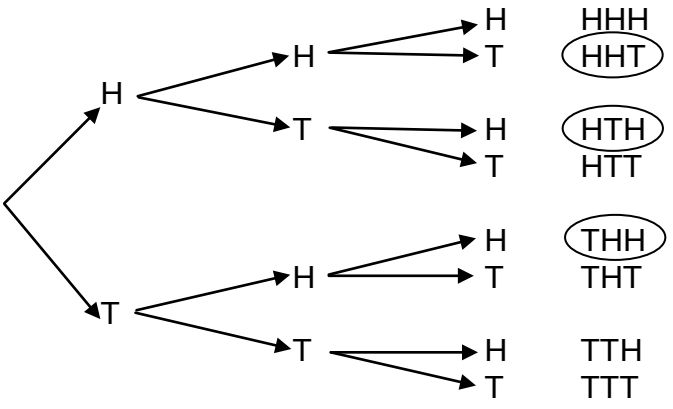
P(A) = n(A) / n(S) = 4/16 = ¼

Using Tree Diagrams to calculate Probability

When you are facing a complicated series of simple events with a small number of outcomes, it is useful to organize the possible outcomes of the larger event in such a way that any probabilities can be determined without using complex mathematics.

Ex. What is the probability of tossing 2 heads in 3 tosses of a coin?

Tree diagram



Outcome Table

Toss 1	Toss 2	Toss 3	Event
H	H	H	HHH
H	H	T	HHT
H	T	H	HTH
H	T	T	HTT
T	H	H	THH
T	H	T	THT
T	T	H	TTH
T	T	T	TTT

Whichever way you count the possibilities, the probability is 3/8.
