Name Mr. L

Standards

M2 10.1 I can represent possible outcomes in a 2-way table, tree, Venn diagram, and with probability statements.

M2 10.2 I can calculate basic and conditional probabilities given frequency of possible outcomes.

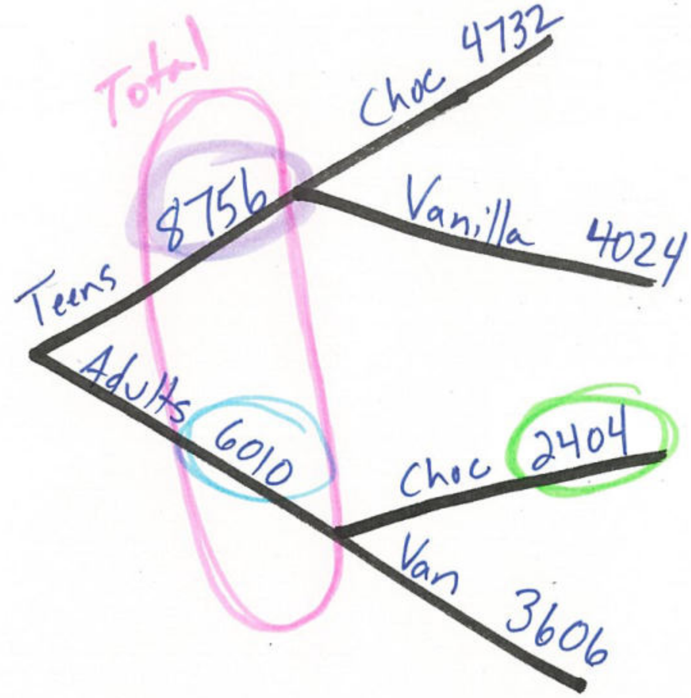
M2 10.3 I can combine outcomes using and, or, and not, and calculate their probabilities.

M2 10.4 I can determine whether two events are independent using two different rules.

Probability

Calculating probabilities
Basic probability - Likelihood of a certain outcome Notation: P(A) "probability of outcome A" EX. P(testing positive for COVID) = $\frac{376}{1000}$ = 37.6% 376 ← # people with COVID 1000 ← total # people
Conditional probability "of A, given B" - If you already know that B happened, what is the probability of A? Notation: P(A | B) "probability of outcome A given outcome B" EX. P(testing positive | have COVID) = $\frac{263}{376}$ 263 ← # people with COVID who tested positive 376 ← # people with COVID

tree diagrams



2-way frequency tables

	Chocolate	Vanilla	Total
Teens	4,732	4,024	8,756
Adults	2,404	3,606	6,010
Total	7,136	7,630	14,766

teens

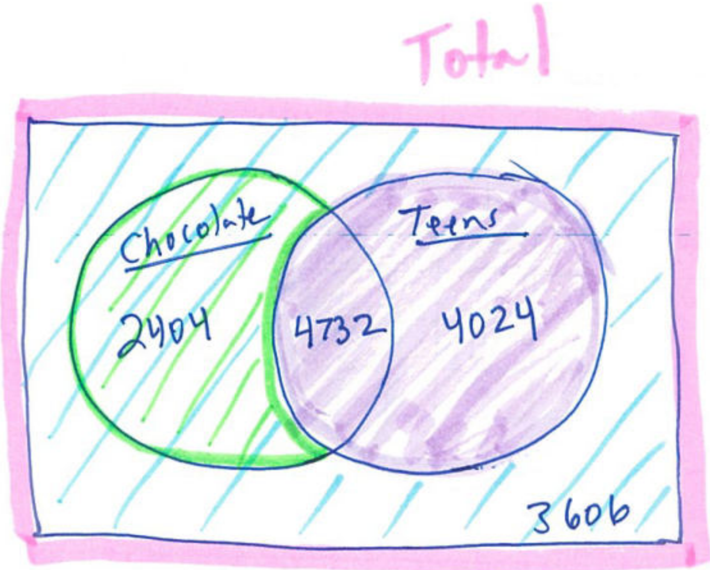
$$P(\text{Teen}) = \frac{8756}{14766}$$

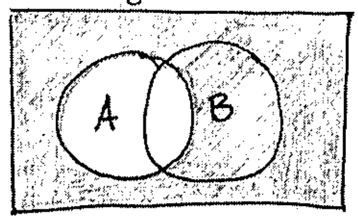
everyone

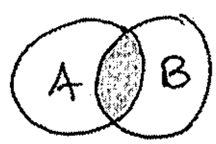
$$P(\text{Prefer Choc} \mid \text{Adult}) = \frac{2404}{6010}$$

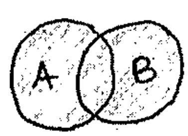
adults who prefer choc

all adults



<table>
<tr><td rowspan="2">Complement of A
Notation:
A'</td><td>Meaning:
everything in the sample that is NOT A</td></tr>
<tr><td>Venn Diagram and Additional Information:


$P(A)+P(A')=1$</td></tr>
<tr><td rowspan="2">Intersection of A and B
Notation:
$A \cap B$
"A intersect B"</td><td>Meaning:
Both event A and B occur</td></tr>
<tr><td>Venn Diagram and Additional Information:


overlap
<u>A and B</u></td></tr>
<tr><td rowspan="2">Union of A and B
Notation:
$A \cup B$
"A union B"</td><td>Meaning:
Either event A or event B occurs (or both)</td></tr>
<tr><td>Venn Diagram and Additional Information:


<u>A or B</u></td></tr>
</table>

addition rule

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

also written as...

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

mutually exclusive, disjoint events:

Two events that cannot occur at the same time
(e.g. - being in both 1^{st} and 2^{nd} class)

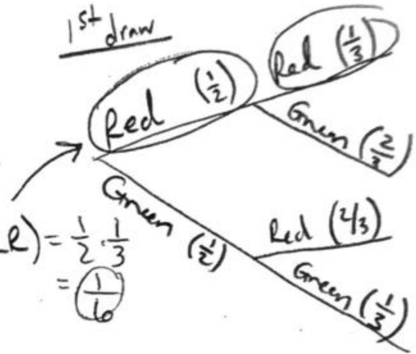
joint events:

Can occur together
(e.g. - 2^{nd} class and surviving)

multiplication rule:

$$P(A \text{ and } B) = P(B) \cdot P(A|B)$$

EX



$$P(RR) = \frac{1}{2} \cdot \frac{1}{3} = \frac{1}{6}$$

$$P\left(\begin{array}{c}\text{Red on } 1^{st} \\ \text{and } 2^{nd} \text{ draws}\end{array}\right) = P\left(\begin{array}{c}1^{st} \text{ draw} \\ \text{Red}\end{array}\right) \cdot P\left(\begin{array}{c}2^{nd} \\ \text{red}\end{array} \middle| \begin{array}{c}1^{st} \\ \text{red}\end{array}\right)$$

$$= \left(\frac{1}{2}\right) \cdot \left(\frac{1}{3}\right)$$

definition of independence:

Knowing one event does not change probability of the other event

$$P(A|B) = P(A) \quad (\text{or } P(B|A) = P(B))$$

multiplication rule for independent events:

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

only true if A+B are independent!

Example

Rolling a 6-sided die

$$P(\text{Rolling 5 twice}) = P(\text{Roll } 5) \cdot P(\text{Roll } 5) = \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$$

2 tests for independence:

test with the definition of independent

A and B are independent if $P(A|B) = P(A)$
or $P(B|A) = P(B)$

multiplication rule test

A and B are independent if $P(A \text{ and } B) = P(A) \cdot P(B)$