FOM 12

5.4 – Mutually Exclusive Events

Notation: When we want to calculate the probability of two events we write
$P(A \cup B)$ = "Probability of A or B"

Mutually Exclusive Events: Events that cannot happen at the same time.
Examples: - Rolling a six sided die and getting an odd or an even
- Rolling two dice and getting "doubles" or an odd sum

For Mutually Exclusive Events $P(A \cup B) = P(A) + P(B)$

Example 1: Find the probability of rolling two dice and getting either doubles or an odd sum.

DICE I / DICE II	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

6 ways to get doubles

18 ways to get odd sum

36 possibilities in the sample space.

$\frac{6+18}{36}$ Favorable outcomes / Total outcomes

$= \frac{24}{36} = \boxed{\frac{2}{3}}$

$\frac{6}{36} + \frac{18}{36}$

P(doubles) + P(odd sum) = P(doubles or odd sum)

* If two events are mutually exclusive then $P(A \cup B) = P(A) + P(B)$

Example 2: Find the probability of rolling two dice and getting a sum that is greater than 7 or a multiple of 5.

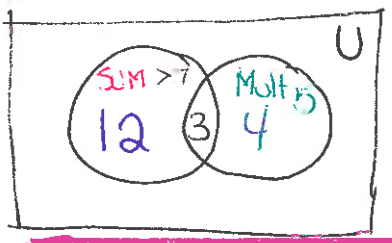
double counts!

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

$P(\text{sum} > 7 \cup \text{mult. } 5) = \frac{15+7-3}{36}$

$= \boxed{\frac{19}{36}}$

USE VENN DIAGRAM



$= \frac{19}{36}$

○ sum > 7
○ mult 5

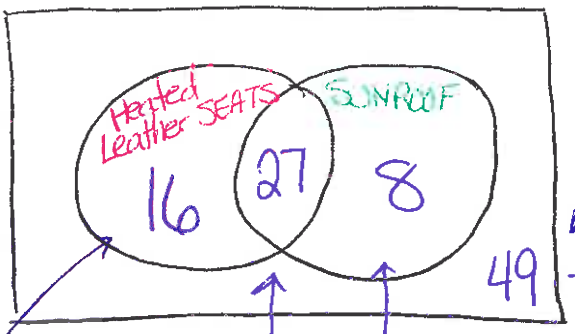
* Not Mutually Exclusive.

* For events that are not Mutually Exclusive:

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

Example 3: A car manufacturer keeps a database of all the cars that are available for sale at all the dealerships in Western Canada. For model A, the database reports that 43% have heated leather seats, 35% have a sunroof, and 49% have neither. Determine the probability of a model A car at a dealership having both heated leather seats and a sunroof.

We can use a Venn Diagram:



- 49% have neither

that means 51% have either heated seats or sunroof.

Heated seats + Sunroof
43 + 35 = 78
(27 have been counted twice)

Heated seat circle must = 43

Sunroof circle must = 35

(check all add to 100%? ✓ YES)

$P(\text{Heated Seats} \ \& \ \text{Sunroof}) = 27\%$

In Summary → For Mutually Exclusive Events: $P(A \cup B) = P(A) + P(B)$

For Non-Mutually Exclusive Events: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Assignment: Pg. 338 #1 – 9, 12 – 15, 17 Extension (#19, 20)