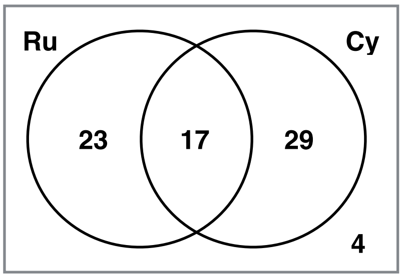
Mutually Exclusive (the OR rule)

Starter

1. **(Review of last lesson)** The Venn diagram shows the members of a sports club with Ru = runners and Cy = cyclists.
   - (a) A member of the club is chosen at random. Find the probability they cycle but don't run.
   - (b) A runner is chosen at random. Find the probability they don't cycle.
   - (c) A cyclist is chosen at random. Find the probability they also run.



Working: (a) "A member of the club is chosen at random." ≡ all members (73)

$$P(\text{don't run}) = \frac{29+4}{23+17+29+4} = \frac{33}{73}$$

(b) "A runner is chosen at random." ≡ only runners considered (23 + 17)
"Don't cycle" ≡ 23 runners don't cycle

$$P(\text{don't cycle given run}) = \frac{23}{23+17} = \frac{23}{40}$$

(c) "A cyclist is chosen at random." ≡ only cyclists considered (17 + 29)
"Also cycle" ≡ 17 cyclists also run

$$P(\text{don't cycle given run}) = \frac{17}{17+29} = \frac{17}{46}$$

N.B. Multiples — the multiples of 6 are 6, 12, 18, 24,… (all the numbers in the 6 times table).

2. A number between 1 and 30 inclusive is chosen at random. What is the probability that the number is:

(a) a multiple of 7	(b) a multiple of 11	(c) a multiple of 7 or 11.
(d) a multiple of 3	(e) a multiple of 5	(f) a multiple of 3 or 5.

Working: (a) There are 4 multiples of 7 (7, 14, 21, and 28) so $\frac{4}{30} = \frac{2}{15}$

(b) There are 2 multiples of 11 (11 and 22) so $\frac{2}{30} = \frac{1}{15}$

(c) There are 6 multiples of 7 or 11 so $\frac{4}{30} + \frac{2}{30} = \frac{6}{30} = \frac{1}{5}$

(d) There are 10 multiples of 3 so $\frac{10}{30} = \frac{1}{3}$

(e) There are 6 multiples of 5 so $\frac{6}{30} = \frac{1}{5}$

(f) We cannot simply add our answers to (d) and (e) together because 15 and 30 are multiples of both 3 and 5 and we would would count them twice.

Hence $\frac{10}{30}+\frac{6}{30}-\frac{2}{30}=\frac{14}{30}=\frac{7}{15}$

3. Discuss in pairs. What is the difference between the calculations for 2(c) and 2(f)?

Working: The outcomes “a multiple of 7” and “a multiple of 11” are mutually exclusive.
That is, they do not have multiples in common — there is no overlap.
This makes the calculation straightforward.
The outcomes “a multiple of 3” and “a multiple of 5” are not mutually exclusive.
That is, they do have multiples in common — there is overlap.
This makes the calculation more complicated.

E.g. 1 A number between 1 and 20 inclusive is chosen at random. What is the probability that the number is:
(a) a multiple of 4 (b) a multiple of 6 (c) a multiple of 4 or 6.

Working: (a) There are 5 multiples of 4 (4, 8, 12, 16 and 20) so $\frac{5}{20}=\frac{1}{4}$

(b) There are 3 multiples of 6 (6, 12, and 18) so $\frac{3}{20}$

(c) 12 is both a multiple of 4 and 6 so we need to subtract from the sum

Hence $\frac{5}{20}+\frac{3}{20}-\frac{1}{20}=\frac{7}{20}$

Video: Mutually exclusive

Solutions to Starter and E.g.s

Exercise
9-1 class textbook: p250 M8.9 Qu 1-11
A*-G class textbook: p210 M8.5 Qu 1-10
9-1 homework book: p60 M8.9 Qu 1-8
A*-G homework book: p60 M8.5 Qu 1-8

Homework book answers (only available during a lockdown)