7.3. Basic Counting Principles

Goals: ① Solve problems using Venn Diagram.

② Multiplication Principle.

Counting using Venn Diagram.

E.g. Survey of 50 students taking 1324.

23 students major in business

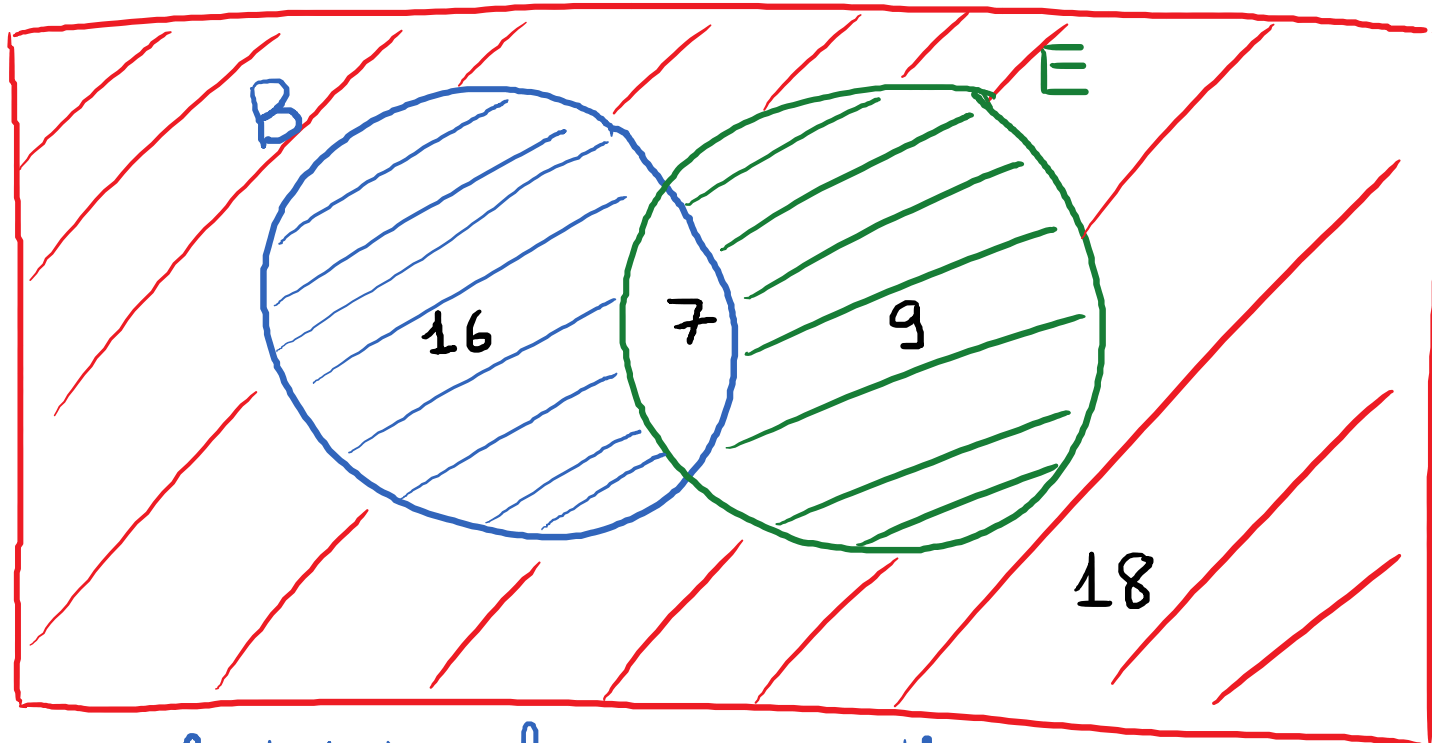16 students major in engineering

7 major in both

Q: How many students major in neither subject?

How many students major in business alone?

$n(U) = 50$ U

B   E

16   7   9

18

# of students who major in neither subject is

$$50 - (16 + 7 + 9) = 18$$

Use set notation to describe the set above: $B' \cap E'$

$$n(B' \cap E') = 18.$$

# of students who major in business alone is 16.

$$n(B \cap E') = 16.$$
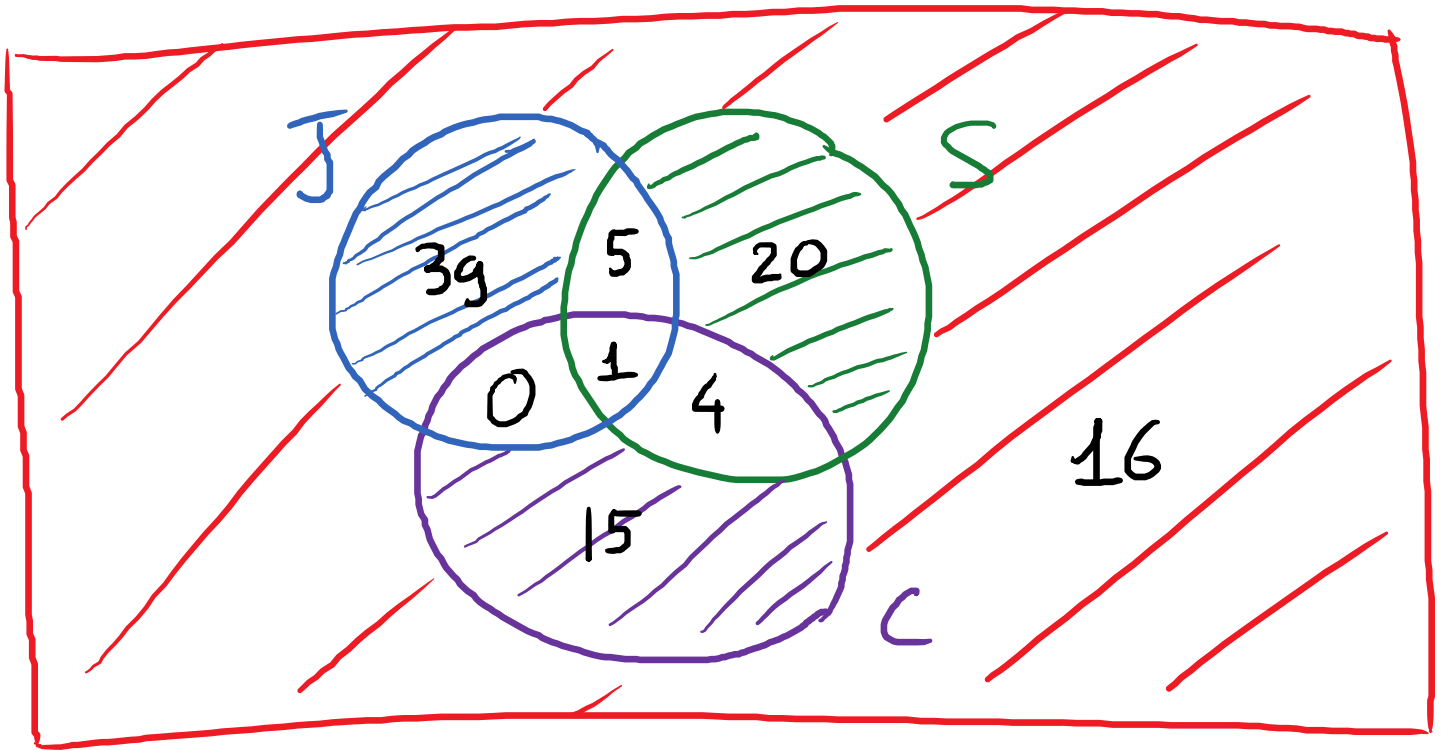
E.g. Survey of 100 college students.

45 jog, 30 swim, 20 cycle.

6 jog and swim, 1 jog and cycle, 5 swim and cycle.

1 does all three

Q: ① How many don't exercise?
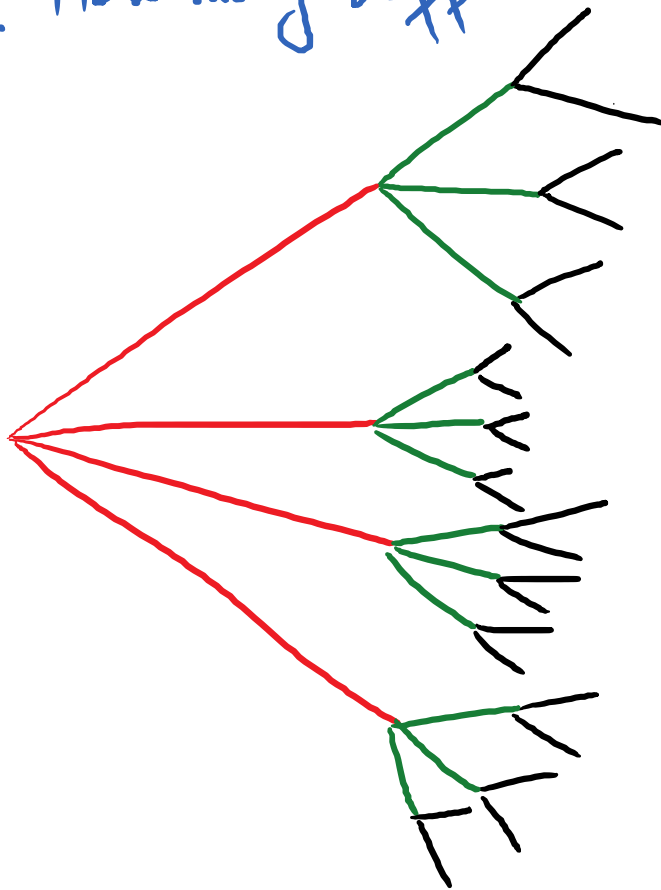
② How many only swim and cycle but don't jog?

① $n(J' \cap S' \cap C') = 16$

② $n(S \cap C \cap J') = 4$.

② Multiplication Principle.

E.g. You bought 4 different pairs of shoes
3 different shirts
2 different pairs of trousers

Q: How many different out fits you can have?

of different outfits

$$\boxed{4} \cdot \boxed{3} \cdot \boxed{2} = 24$$

Stage 1   Stage 2   Stage 3
Select   Select   Select
a pair of   a   a pair
shoe   shirt   of
                              trousers

E.g. Group of 28 people.
Board of director of a company.

$$\boxed{28} \cdot \boxed{27} \cdot \boxed{26} = 19656$$

 ①   ②   ③

E.g. License Plate: 3 letters followed by 4 numbers

$$26 \cdot 26 \cdot 26 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 26^3 \cdot 10^4$$