7.3. Basic Counting Principles

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Goals: (1) Solve counting problems using Venn Diagram.

(2) Multiplication Principle.

Counting using Venn Diagram.

E.g. Survey of 50 students taking 1324

23 students major in business → B

16 students major in engineering → E

7 students major in both.

Q: How many students major in neither subject?

How many students major in business but not engineer.

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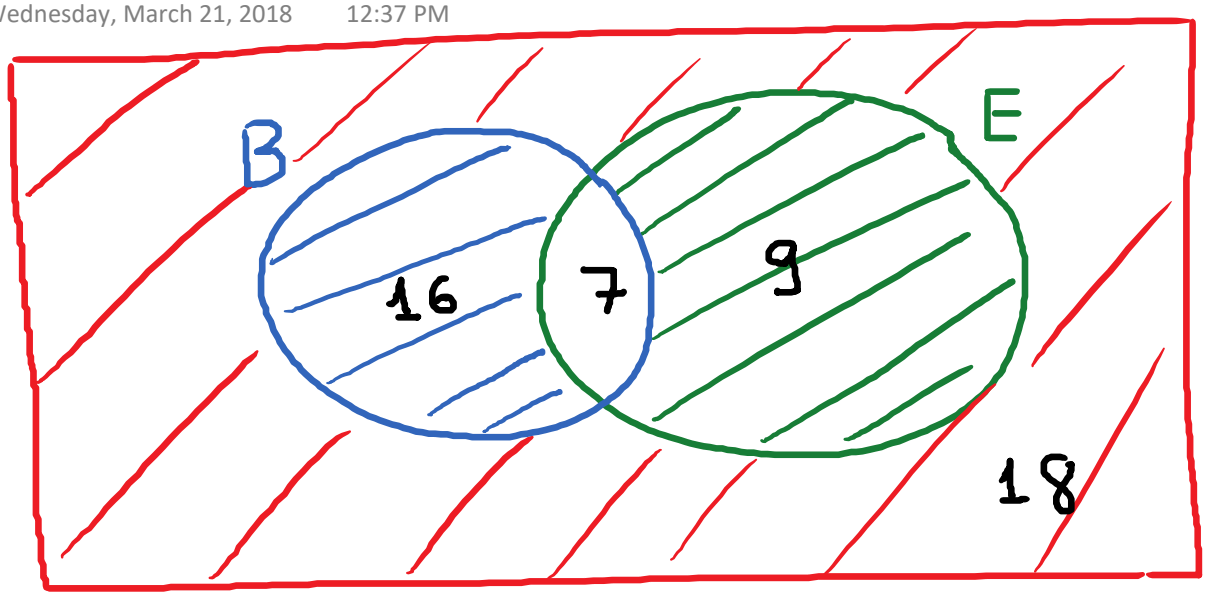


Ans: 18 students major in neither subject

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

16 students major in Business alone.

$(B \cap E')$

$n(B \cap E') = 16$

E.x. Survey of 100 students.

45 jog, 30 swim, 20 cycle.

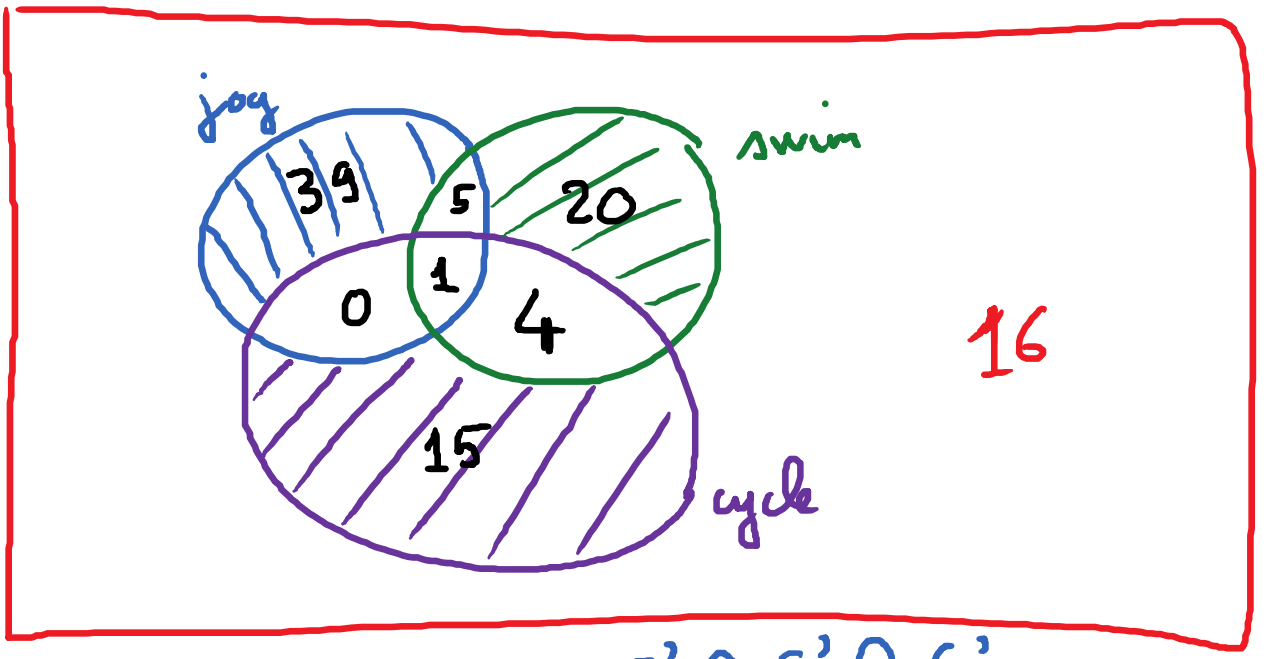
6 jog and swim | 5 swim and cycle

1 jog and cycle

1 does all three.

Q: (1) How many students don't exercise?

(2) How many only swim and cycle but don't jog?



$J' \cap S' \cap C'$

(1) # of students who don't exercise = 16

(2) # of students who swim and cycle but don't jog is $4. (S \cap C \cap J')$

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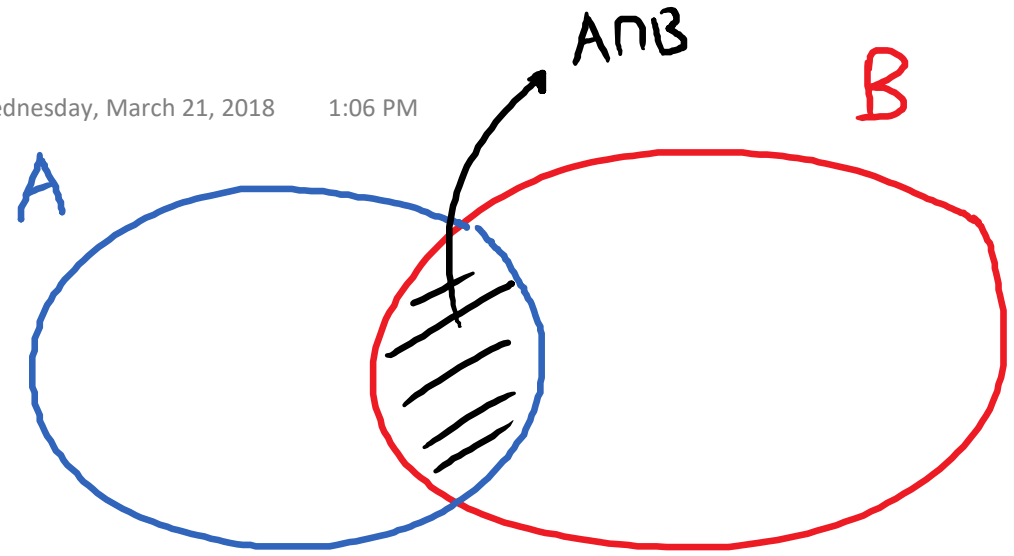


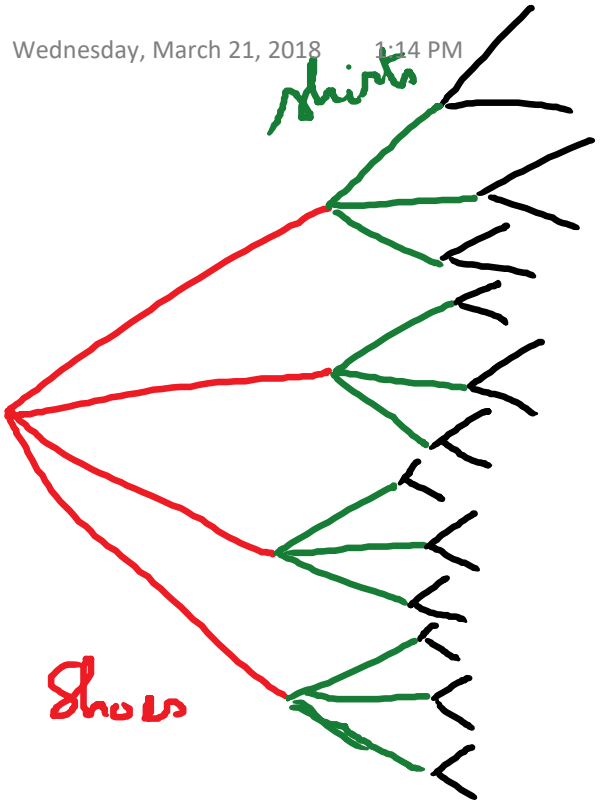
$$n(A) + n(B) = n(A \cup B) + n(A \cap B)$$

$$\longrightarrow n(A) + n(B) - n(A \cap B) = n(A \cup B)$$

(2) Multiplication Principle.

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

Q: How many different outfits can you have?



$4 \cdot 3 \cdot 2 = 24$

different outfits

E.g.