Honors Advanced Algebra

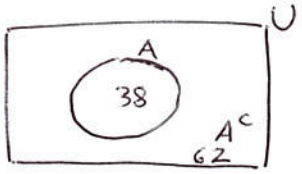
DATE: _____

Venn Diagrams

There are 100 students. 38 of them read comic books. Draw a *Venn diagram* to represent the situation. What is the probability that a randomly selected student…

$100 - 38 = 62$

Venn diagram



whole space 100 students

a) reads comic books? (call this event A)

$$P(A) = \frac{38}{100} = \frac{19}{50}$$

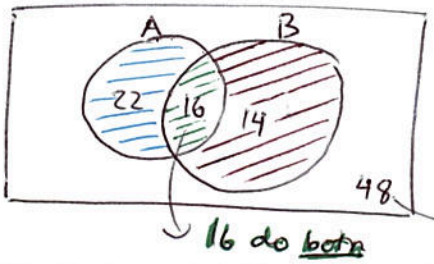
b) does not read comic books?

$$P(A^c) = 1 - P(A) = 1 - \frac{38}{100} = \frac{62}{100} = \frac{31}{50}$$

Intersection of Events

Notation: $P(A) = \frac{n(A)}{n(U)}$ ← # of set A / ← Total # in space U

Of the 100 students, 30 students play soccer. Of those, 16 do both, read comic books and play soccer (let B represent the event of "playing soccer"). How many students just play soccer? How many students just read comic books? Draw a *Venn diagram* to represent this situation.



16 do both

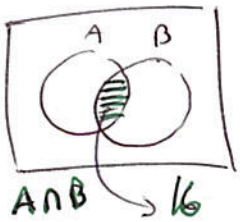
$30 - 16 = 14$

$38 - 16 = 22$ (See above in warm↑)

∴ 14 just play soccer and 22 just read comic books

48 students don't play soccer or read comic books

What is the probability that a randomly selected student engages in both activities, reads comic books and plays soccer? Draw a *Venn diagram*.

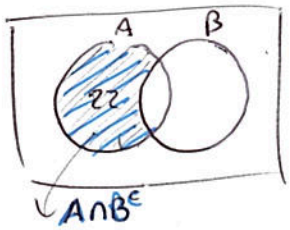


$n(A \cap B)$

$n(U) = 100$

$$\therefore P(A \cap B) = \frac{n(A \cap B)}{n(U)} = \frac{16}{100} = \frac{4}{25}$$

What is the probability that a randomly selected student does not play soccer but does read comic books? Draw a *Venn diagram*.

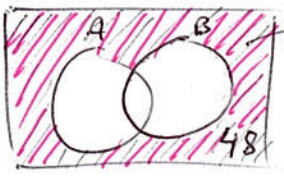


$n(A \cap B^c) = 22$

$n(U) = 100$

$$\therefore P(A \cap B^c) = \frac{n(A \cap B^c)}{n(U)} = \frac{22}{100} = \frac{11}{50}$$

What is the probability that a randomly selected student does not engage in both activities, does not read comic books or play soccer? Draw a *Venn diagram*.



$A^c \cap B^c$

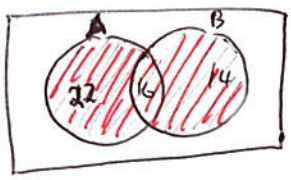
$n(A^c \cap B^c) = 48$

$n(U) = 100$

$$\therefore P(A^c \cap B^c) = \frac{n(A^c \cap B^c)}{n(U)} = \frac{48}{100} = \frac{12}{25}$$

Union of Events

What is the probability that a randomly selected student either reads comic books or plays soccer (does "or" include the possibility of both?). Draw a *Venn diagram*.



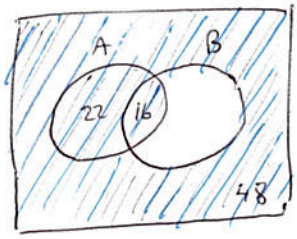
$n(A \cup B) = 22 + 16 + 14 = 52$

$n(U) = 100$

$\therefore P(A \cup B) = \frac{n(A \cup B)}{n(U)} = \frac{52}{100} = \frac{13}{25}$

$A \cup B^C$ represents students that either do comic books or don't play soccer.

Draw a *Venn diagram* and find $P(A \cup B^C)$.



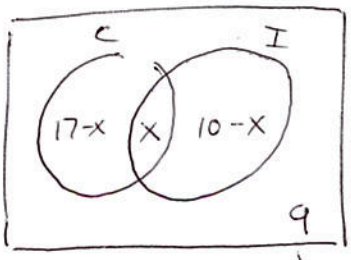
$n(A \cup B^C) = 22 + 16 + 48 = 86$

$P(A \cup B^C) = \frac{n(A \cup B^C)}{n(U)} = \frac{86}{100} = \frac{43}{50}$

Now you try it!

In a group of 30 students, 17 play computer games, 10 play instruments and 9 play neither.
Draw a *Venn diagram* to show this information. Use your diagram to find the probability that:

a) a student chosen at random from the group plays instruments,
b) a student plays both computer games and instruments,
c) a student plays instruments but not computer games.



Let C = play computer games
I = play instruments
We don't know how many do both!
So, let $x = n(C \cap I)$

$\therefore n(C \cap I^C) = 17 - x$
$n(C^C \cap I) = 10 - x$

neither

$\therefore$ Set up equation:

$(17 - x) + x + 10 - x + 9 = 30$

$36 - x = 30$
$-x = -6$
$x = 6$

a) $P(I) = \frac{10}{30} = \frac{1}{3}$

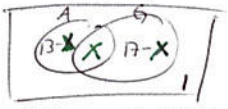
b) $P(C \cap I) = \frac{6}{30} = \frac{1}{5}$

c) $P(I \cap C^C) = \frac{4}{30}$

There are 25 girls in a PE group. 13 have taken aerobics before and 17 haven taken gymnastics. One girl has done neither before. How many have done both activities?

Let $x = n(A \cap B)$

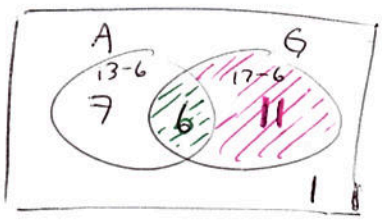
G = gymnastics
A = aerobics



$13 - x + x + 17 - x + 1 = 25$
$31 - x = 25$
$-x = -6$
$x = 6$

One girl is chosen at random. Find the probability that:

a) she has taken both activities,
b) she has taken gymnastics but not aerobics.



a) $P(A \cap G) = \frac{6}{25}$

b) $P(G \cap A^C) = \frac{11}{25}$