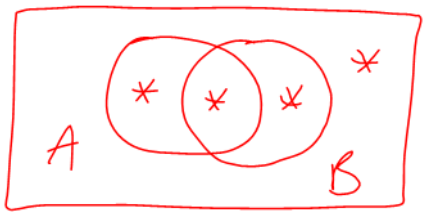
3.3 Venn Diagrams and Counting

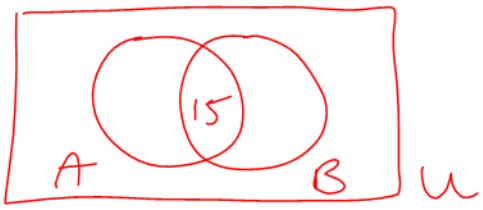
A Venn diagram for two sets contains four **basic regions**. Let's draw a Venn diagram for sets A and B, and observe the four basic regions.



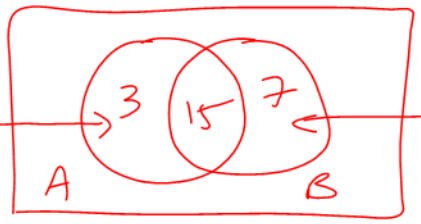
Example: We are given: $n(U) = 60, n(A) = 18, n(B) = 22$ and $n(A \cap B) = 15$.

a) Draw a Venn diagram.

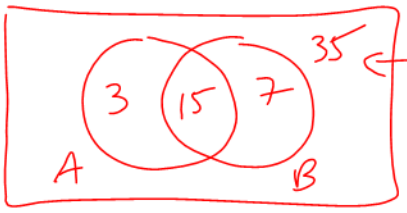
Start with a basic region.



18-15



22-15



60-3-15-7

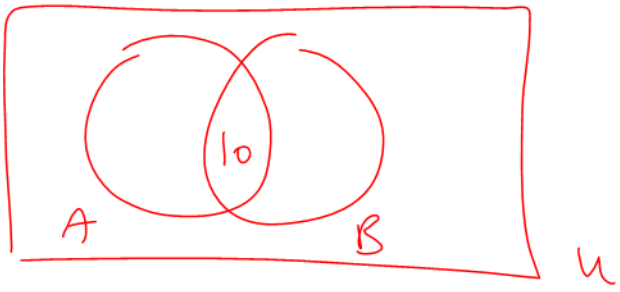
b) How many elements are in A but not in B?

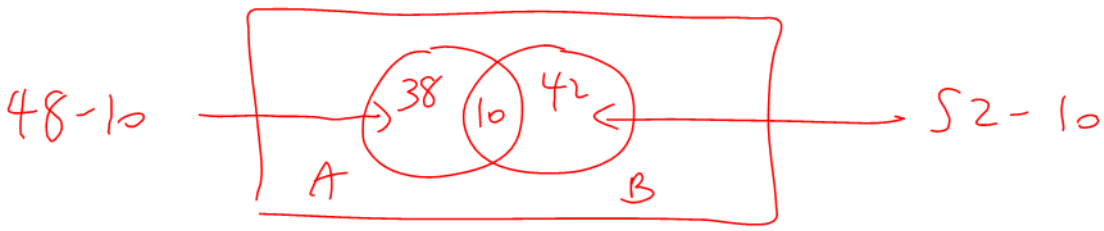
3

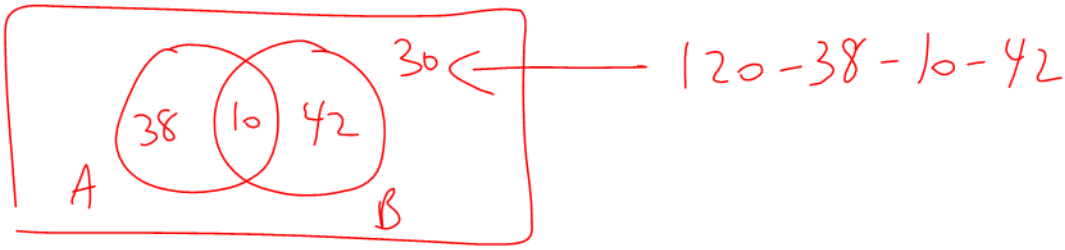
Example: We are given: $n(U) = 120, n(A) = 48, n(B) = 52$ and $n(A \cup B) = 90$. Draw a Venn diagram.

Start with a basic region.

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$
$$90 = 48 + 52 - n(A \cap B)$$
$$90 - 48 - 52 = -n(A \cap B)$$
$$-10 = -n(A \cap B)$$
$$10 = n(A \cap B)$$

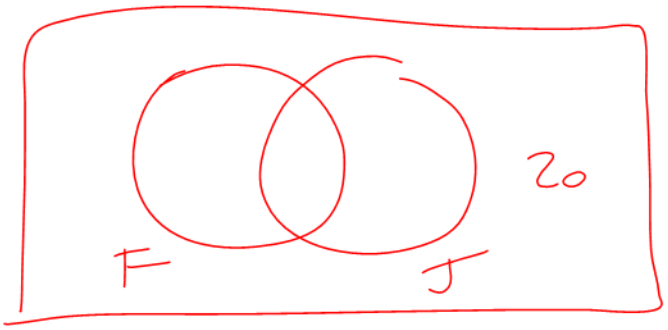






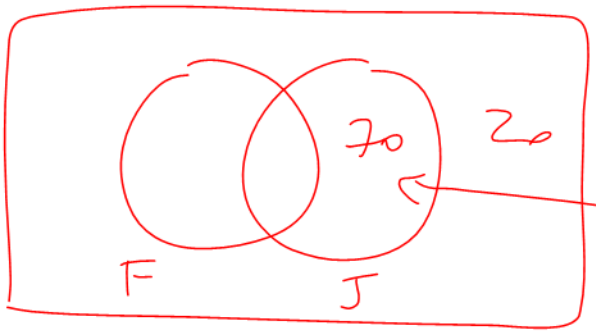
Example: Out of 150 students, 60 are first-year, 112 have a job and 20 are non-first-year with no job. Draw a Venn diagram.

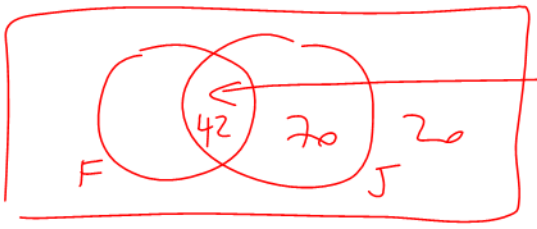
Let F = first-year students
J = students with a job

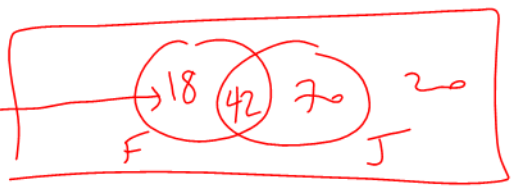


$n(F) = 60$ ← first-year

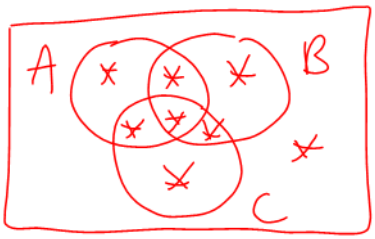
$n(F') = 150 - 60 = 90$ ← non-first-year







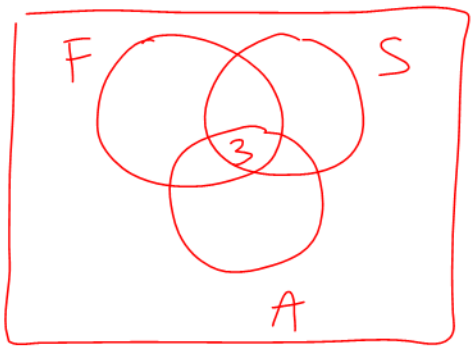
A Venn diagram for three sets contains eight **basic regions**. Let's draw a Venn diagram for sets A, B and C, and observe the eight basic regions.

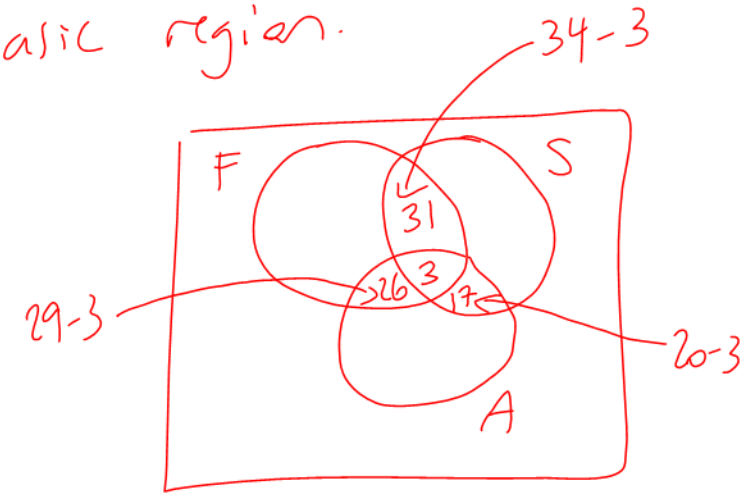


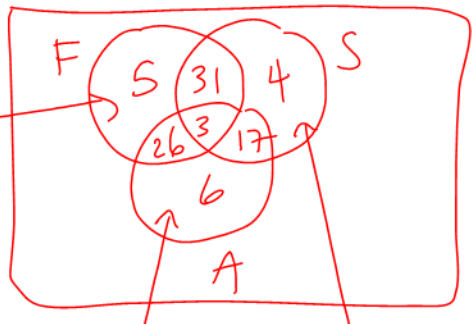
Example: Of 100 employees: 65 speak French, 55 speak Spanish, 52 speak Arabic, 34 speak French and Spanish, 29 speak French and Arabic, 20 speak Spanish and Arabic, and 3 speak all three languages. Draw a Venn diagram.

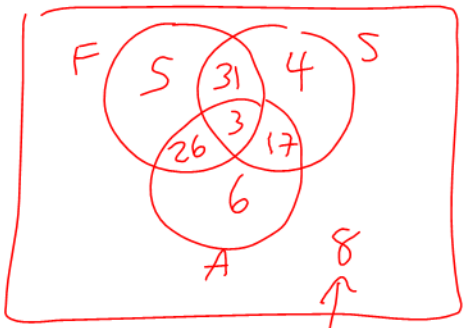
Let F = Speak French
S = " Spanish
A = " Arabic

Start with a basic region.







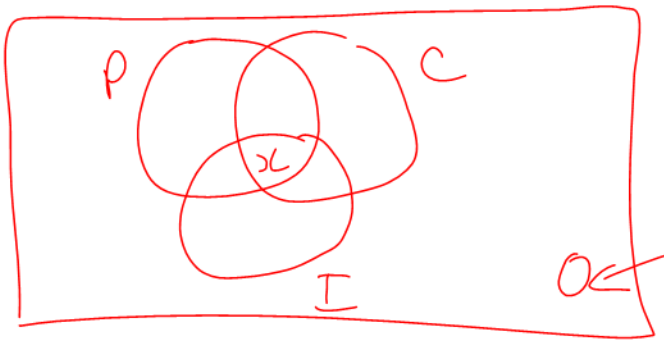


Example: Each of 100 job applicants has at least one type of experience: presentation, coding or international experience. Draw a Venn diagram given that:

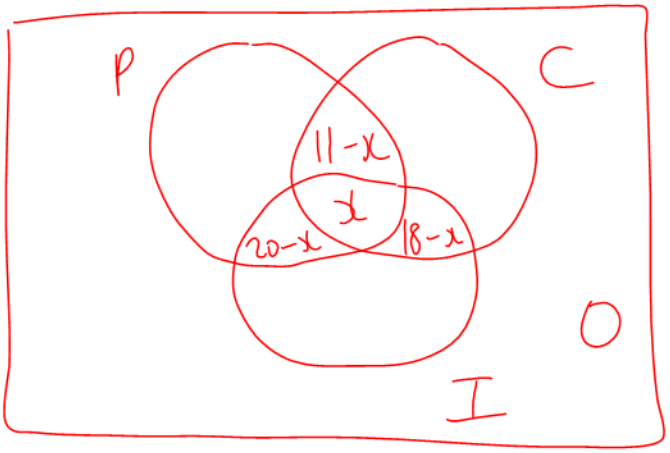
45 have presentation experience
56 have coding experience
41 have international experience
11 have presentation and coding experience
20 have presentation and international experience
18 have coding and international experience

Let P = presentation experience
C = coding "
I = international "

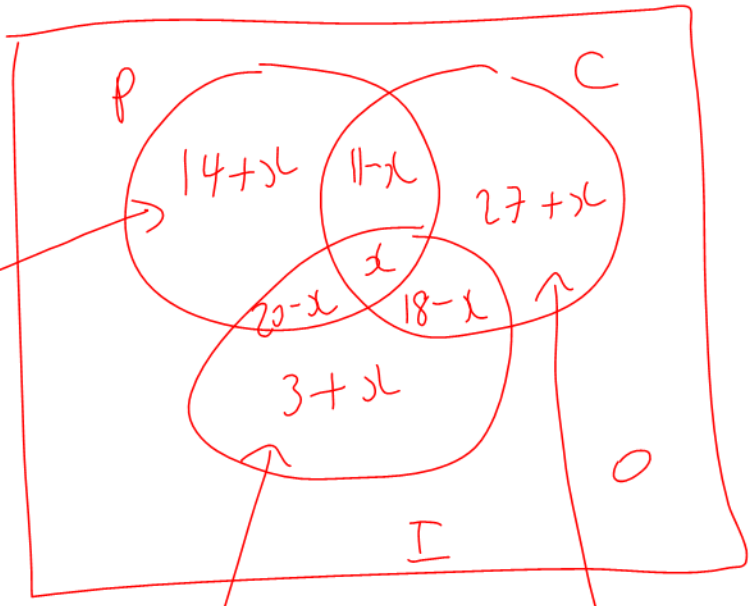
Start with a basic region.
Let $n(P \cap C \cap I) = x$



all have at least 1 type of experience



Example Continued...



$45-(11-x)$
$-(20-x)-x$
$= 45-11+x$
$-20+x-x$
$= 14+x$

$41-(20-x)$
$-x-(18-x)$
$= 41-20+x$
$-x-18+x$
$= 3+x$

$56-(11-x)$
$-x-(18-x)$
$= 56-11+x$
$-x-18+x$
$= 27+x$

But $n(U)=100$

$(14+x)+(11-x)+(27+x)$
$+(20-x)+x+(18-x)$
$+(3+x)+0 = 100$

$93+x=100$
$x=7$