1. If $|A_1| = 12$ and $|A_2| = 18$ and
   a) $A_1 \cap A_2 = \emptyset$, then $|A_1 \cup A_2| = 12 + 18 - 0 = 30$
   b) $|A_1 \cap A_2| = 1$, then $|A_1 \cup A_2| = 12 + 18 - 1 = 29$
   c) $|A_1 \cap A_2| = 6$, then $|A_1 \cup A_2| = 12 + 18 - 6 = 24$
   d) $A_1 \subseteq A_2$, then $|A_1 \cup A_2| = 12 + 18 - 12 = 18$

3. A survey shows 96% have at least 1 TV, 98% have telephone service, and 95% have both TV and phone. What percentage have neither TV nor telephone service? $100 - [96 + 98 - 95] = 1\%$

5. Find $|A_1 \cup A_2 \cup A_3|$ if there are 100 elements in each set, and
   a) the sets are pairwise disjoint $100 + 100 + 100 - 0 - 0 - 0 + 0 = 300$
   b) there are 50 common elements in each pair and none in all three. $100 + 100 + 100 - 50 - 50 - 50 + 0 = 150$
   c) there are 50 common elements in each pair and 25 in all three. $100 + 100 + 100 - 50 - 50 - 50 + 25 = 175$
   d) the sets are equal. 100

7. There are 2504 CS students. Of these 1876 have studied Pascal, 999 have studied Fortran, and 345 have studied C. Further, 876 have studied both Pascal and Fortran, 231 have studied both Fortran and C, and 290 have studied both Pascal and C. If 189 have studied all three courses, how many of these CS students have not studied any of these languages? $2504 - [1876 + 999 + 345 - 876 - 231 - 290 + 189] = 492$

11. Find the number of positive integers not exceeding 100 that are either odd or a square. $50 + 10 - 5 = 55$

13. How many bit strings of length 8 do not contain 6 consecutive 0's? $2^8 - 5 - 2 - 1 = 248$

15. How many permutations of the 10 digits either begin with 987, or contain 45 in positions five and six, or end with 123? $7! + 8! + 7! - 5! - 4! - 5! + 2! = 50138$

17. How many elements are in the union of four sets which have 50, 60, 70, and 80, respectively, each pair has 5 elements in common, each triple has 1 element in common, and no element is in all four sets? $50 + 60 + 70 + 80 - 5 - 5 - 5 - 5 - 5 - 1 + 1 + 1 + 1 - 0 = 234$

19. The formula for the size of the union of five sets $A_1$, $A_2$, $A_3$, $A_4$, $A_5$ is
   \[ |A_1 \cup A_2 \cup A_3 \cup A_4 \cup A_5| = |A_1| + |A_2| + |A_3| + |A_4| + |A_5| - |A_1 \cap A_2| - |A_1 \cap A_3| - |A_1 \cap A_4| - |A_1 \cap A_5| - |A_2 \cap A_3| - |A_2 \cap A_4| - |A_2 \cap A_5| - |A_3 \cap A_4| - |A_3 \cap A_5| - |A_4 \cap A_5| + |A_1 \cap A_2 \cap A_3| + |A_1 \cap A_2 \cap A_4| + |A_1 \cap A_2 \cap A_5| + |A_1 \cap A_3 \cap A_4| + |A_1 \cap A_3 \cap A_5| + |A_1 \cap A_4 \cap A_5| + |A_2 \cap A_3 \cap A_4| + |A_2 \cap A_3 \cap A_5| + |A_2 \cap A_4 \cap A_5| + |A_3 \cap A_4 \cap A_5| \]