1. Complete the Inclusion/Exclusion formulas:
   (a) \(|A \cup B| =
   
   \hspace{2cm}
   
   \hspace{2cm}
   
   (b) \(|A \cup B \cup C| =
   
   \hspace{2cm}
   
   \hspace{2cm}

2. Complete the table giving the number of ways to make an unordered selection of
   \(k\) things from \(n\) possibilities:

   \[
   \begin{array}{|c|c|}
   \hline
   \text{repetition allowed} & \text{repetition not allowed} \\
   \hline
   \text{ } & \text{ } \\
   \hline
   \end{array}
   \]
3. Count the subsets of the set \{A,B,C,D,E,F,G\}:
   (a) which have 3 elements
   (b) which have 3 elements and contain C
   (c) whose intersection with \{A,B,C,D\} has size 2

4. How many ways are there to select, from a barrel of 45 numbered balls:
   (a) six balls, and then colour one of them red
   (b) one ball to colour red, and then five more balls

5. Count the four-digit numbers
   (a) whose digits are two 1’s and two 2’s in some order
   (b) whose digits are two 1’s, a 2, and a 3 in some order
   (c) whose digits are a 1, a 3, a 7, and a 0 in some order
   (d) whose digits decrease strictly from left to right
   (e) whose digits increase strictly from left to right
6. Suppose $A, B, C$ are subsets of a finite set $X$ such that 
\[ |A| = 30, \ |B| = 40, \ |C| = 20, \ |A \cup B| = 60, \ |A \cap C| = 5, \ |B \cap C| = 0. \]

(a) Find $|A \cup C|$.

(b) Find $|A \cap B|$.

(c) Find $|A \cup B \cup C|$.

7. (It may help to know that $S(7, 3) = 301$.) How many ways can you distribute 7 packages among three people A, B, and C if:

(a) there are no restrictions

(b) the packages are all different and no-one must miss out

(c) the packages are all different and exactly one person must miss out

(d) the packages are all different and person A must get three, person B and person C two each

(e) the packages are indistinguishable

(f) the packages are indistinguishable and no-one must miss out

(g) the packages are indistinguishable and exactly one person must miss out

(h) the packages are indistinguishable and person A must get three, person B and person C two each
8. For each of the following statements, write T for true or F for false.

(a) The product of any 5 consecutive integers is divisible by 120. 

(b) There are 20 ways to split 6 people into two teams of 3.

(c) \[ A \cap (B \cup C) = (A \cap B) \cup C. \]

(d) \[ A \setminus (B \cup C) = (A \setminus B) \cap (A \setminus C). \]

(e) \[ (A \cup B) \setminus C = (A \setminus C) \cup (B \setminus C). \]

(f) The Stirling numbers satisfy \[ S(n, k) = S(n-1, k-1) + S(n-1, k). \]

(g) For all \( n \geq 1 \), \[ S(n, n-1) = \binom{n}{2}. \]

(h) For all \( n \geq 1 \), \[ S(n, n) = \binom{n}{n}. \]

(i) There are \( S(n, k) \) surjective functions \( \{1, \ldots, n\} \to \{1, \ldots, k\}. \)