1. Evaluate and simplify the following:
   
   (a) \( P(120, 118) \)
   
   (b) \( \frac{1001!}{999!} \)
   
   (c) Express in terms of factorials:
   
   \[
   13 \cdot 14 \cdot 101 \cdot (n - 1)(n - 2) \cdot \ldots \cdot (n - k)
   \]

2. Use the Euclidean Algorithm to compute the gcd(2392, 4328).

3. Select a theta notation from among \( \Theta(1), \Theta(n), \Theta(n^2), \Theta(n^3), \Theta(n^4), \Theta(2^n), \Theta(n!) \)
   
   (a) for the following expression \( 4n^3 + 2n - 5 \)
   
   (b) for the number of times the line \( x := x + 1 \) is executed
   
   \[
   \text{for } i := 1 \text{ to } n \\
   \quad \text{for } j := 1 \text{ to } i^2 \text{ do} \\
   \quad \quad x := x + 1
   \]

4. PERMUTATIONS
   
   (a) How many different permutations are there of the letters in the word PERMUTATIONS?
   
   (b) How many different 5-letter words can be created using letters from the word PERMUTATIONS if no letter can be repeated?

5. Four playing cards are selected from a standard pack of 52? In how many different ways can this be done if the four cards consist of
   
   (a) one card from each suit?
   
   (b) two clubs, one diamond, one heart?
   
   (c) four cards all from the same suit?

6. How many different solutions are there of the equation \( a + b + c + d + e = 17 \), where \( a, b, c, d, e \) are non-negative integers?
7. Five balls are taken out of a box one at a time without replacement. The box contains ten black and six white and seven red balls. How many ways are there in choosing the five balls

(a) without restrictions?
(b) when two are black?
(c) when all have the same color?
(d) when at least two are white?

Two cases: in each color balls are distinct, in each color balls are NOT distinct.

8. A bag contains 24 socks, consisting of 12 pairs, each pair having a different pattern. How many socks must be taken out at random to get a matching pair?

9. How many 4-digit decimal numbers (with non-zero first digit)

(a) contain at least one of the digits 0 or 1?
(b) do not contain at least one of the digits 0 and 1?

10. Binomial Theorem

(a) Write the Pascal’s triangle so you can expand \((a + b)^{10}\).
(b) Determine the coefficient of \(x^6y^4\) in \((-4x - .5y)^{10}\).
(c) Use the Binomial Theorem to prove that for every natural \(n\)

\[
\sum_{k=0}^{n} (-1)^k C(n, k) = 0.
\]

11. Solve the recurrence relation subject to the initial conditions

\[a_n = -4a_{n-1} - 4a_{n-2}, \quad a_0 = 2, \quad a_1 = 4.\]