Algorithms - *Computer Science*

Demo Practice Sheet

Q1. A 128 meter long rope is to be repeatedly cut at half the length every time, with the first half discarded each time.
   a.   How many cuts are required so that we are left with 1 meter rope in the end?
   b.   What is the total length of discarded rope?

Q2. There are 26 banners to be printed, each 1-page banner being an English alphabet in upper case, to be printed in one of the three colors - Red, Green, Blue. There are only three printers - one for each color. Each alphabet is to be printed on a single-page banner and *only once* (in any of the three colors). Find the number of total different ways the 26 banners can be printed?

Q3. Simplify the below recursive functions **T(n)** in terms of **n**. Also tell whether the functions are **Linear**, **Quadratic**, **Polynomial** with degree > 2, or **Logarithmic**. Assume **T(1) = T(0) = 5**.

   a.   **T(n) = T(n-1) + 4**
   b.   **T(n) = 4 T(n-1) + 4**
   c.   **T(n) = T(n-1) + T(n-2) + 1**
   d.   **T(n) = T($\frac{n}{2}$) + 2**
   e.   **T(n) = T($\frac{n}{2}$) + T($\frac{n}{2}$) + 1**
   f.   **T(n) = 4 T($\frac{n}{2}$) + 4**

Solution to 3(a) is done for you:

T(n) = T(n-1) + 4
*   = [T(n-2) + 4] + 4   =   T(n-2) + 2*4*
*   = [[T(n-3) + 4] + 4] + 4   =   T(n-3) + 3*4*
*   = … (so on) … until the last one…*
*   = [[T(n- (n-1)) + 4] + … + 4] + 4   =   T(1) + (n-1) *4*
*   = 5 + 4(n - 1)*
*   = 4n + 1   ⇒ Thus, **Linear** with respect to **n**.*