

# ***Polynomial Reduction***

***So, far , linear recurrences have been solved using methods such as guess and verify, substitution, and recurrence tree.***

***However these methods are not useful for solving recurrence equations of a higher order, for which the polynomial reduction method is used.***

***The idea is to reduce the recurrence equation to a characteristic equation and express its solution in terms of its roots.***

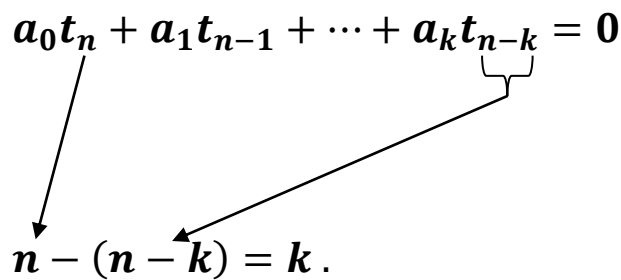
***A linear recurrence equation of the order `k` can be expressed in the following form:***

$$a_0t_n + a_1t_{n-1} + \cdots + a_k t_{n-k} = 0$$

***This equation is linear because it does not involve any square, square root, or cubic terms.***

***In addition, the order of this linear recurrence is `k`***

*as the difference between the highest and the smallest suffix is :*

$$a_0 t_n + a_1 t_{n-1} + \cdots + a_k t_{n-k} = 0$$


$$n - (n - k) = k .$$

*The following are the steps involved in the polynomial reduction procedure used for solving a recurrence equation:*

- 1. Form a characteristic equation for the given recurrence equation.*
- 2. Find the roots of the characteristic equation.*
- 3. Find a general solution with unknown coefficients.*
- 4. Solve the equations with respect to the initial conditions to get a specific solution.*

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