
Mathematical Methods for Computer Science II

Spring 2017

Outline 5

3.5. Linear recursive equations.

Definition: A sequence of numbers $(a_n)_{n \in \mathbb{N}}$ is **recursively defined** if it is given by

$$a_n = \begin{cases} \alpha_n & n < r \\ \gamma_1 a_{n-1} + \gamma_2 a_{n-2} + \dots + \gamma_r a_{n-r} + \varphi(n) & n \geq r \end{cases}$$

where $\alpha_0, \alpha_1, \dots, \alpha_{r-1}$ and $\gamma_1, \dots, \gamma_r$ are given numbers and φ is a function.

The equations

$$a_n = \alpha_n, \quad n < r$$

are called **initial conditions** and

$$a_n = \gamma_1 a_{n-1} + \gamma_2 a_{n-2} + \dots + \gamma_r a_{n-r} + \varphi(n)$$

is a **linear recursive equation of order r with constant coefficients**.

In the special case $\varphi(n) = 0$, the linear recursive equation is called **homogeneous**.