# Assignment 1

1. Find the solution for the following difference equations:

   (a) $x_{n+1} = \left(\frac{n+1}{n+2}\right)^2 \cdot x_n + \frac{1}{n+2}, \quad x_0 = 1;$

   (b) $x_{n+3} - 4 \cdot x_{n+2} + x_{n+1} + 6 \cdot x_n = 60 \cdot 4^n, \quad x_0 = 2,\ x_1 = 12,\ x_2 = 12;$

   (c) $x_{n+1} = \frac{2 \cdot x_n}{1 + 4 \cdot x_n}, \quad x_0 = 1$ (Hint: use substitution $x_n = \frac{1}{y_n}$)

2. Let us consider the difference equation:

$$x_{n+1} = \frac{x_n^2 + 7}{2x_n}.$$

   (a) Find the equilibrium points and study their stability.

   (b) Do some numerical simulations.

3. Let us consider the system of difference equations:

$$\begin{cases} x_{n+1} &= x_n - x_n^2 - x_n y_n \\ y_{n+1} &= 2y_n - y_n^2 - 3x_n y_n \end{cases}$$

   (a) Find and study the stability of the equilibrium points.

   (b) Do some numerical simulations.

4. Let's consider the simple interest model

$$S_{n+1} = S_n + pS_0$$

   and the compound interest model

$$S_{n+1} = S_n + \frac{p}{r} S_n.$$

   Company A offers simple interest at an annual rate of 4%. Company B offers compound interest at an annual rate of 3% with a conversion period of one month.

   (a) Calculate for the both cases the amount on deposit after 5, 10, 15, and 20 years for principal $S_0 = 1000$.

   (b) Determine which interest offer maximizes the amount on deposit after 5, 10, 15 and 20 years?