**AMERICAN UNIVERSITY OF ARMENIA**
College of Science and Engineering
ENGS 121 Mechanics

Reference: Chapter 2. Newton's Laws, pages 48-77, Problems 2.13, 2.14 (page 79); Chapter 3. Forces and Equations of Motion, section 3.4, pages 89-95; Quiz03_solutions.pdf

Description: Consider a system of a massless pulley $M_0 = 0$ and three masses M_1, M_2 and M_3, as shown. The body M_1 can slide on a table, and the friction coefficient between M_1 and the table is $\square_1$. M_2 can slide on a horizontal surface of M_1, and the friction coefficient between M_1 and M_2 is $\square_2$. M_3 can slide in the vertical hole of M_1, and the friction coefficient between M_1 and M_3 is $\square_3$. The pulley is rigidly mounted on M_1. The acceleration of gravity g is directed downwards. The length of the rope connecting M_2 and M_3 is guaranteed to be such that M_3 cannot escape from the hole, M_2 cannot fall beyond the left edge of M_1, and M_2 stops at the pulley when M_3 hits the bottom of the hole. Generally, the system moves under the action of an external horizontal force F that may act in either in (x_1, y_1) negative (as shown) or positive x direction. The list of y main parameters includes:

- $0 < M_1, M_2, M_3 \leq 10$ kg; $M_0 = 0$;
- $0 \leq \square_1, \square_2, \square_3 \leq 0.5$;
- **-300** N $\leq F \leq$ **300** N; -   Take $g = 10$ m/s^2.
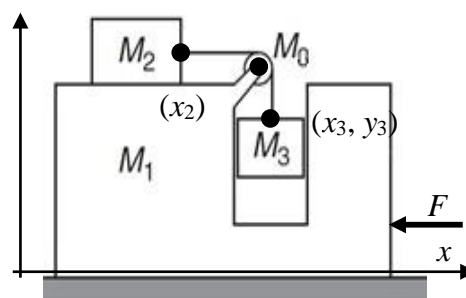
Tasks:

1. Write a program that inputs several time moments $t_0 = 0, t_1, t_2, \ldots t_n$ in seconds and the values of the force $F_0 = F(0), F_1 = F(t_1), F_2 = F(t_2), \ldots F_n = F(t_n)$ in Newtons from the specified range; the parameters $M_1, M_2, M_3, \square_1, \square_2$ and $\square_3$ from the specified ranges; the initial positions of M_1, M_2 and M_3 in meters at $t_0 = 0$; and computes the subsequent positions of M_1, M_2 and M_3 for several values $t > 0$. Assume a linear interpolation of F for the points between $t_0, t_1, t_2, \ldots t_n$.

2. Run the program for different sets of input parameter values and prepare a short report that summarizes the most interesting cases. Include in the report the computed outputs in graphical or tabular formats