

# Programming Assignment

## *Signal Flow Graphs &*

## Routh Stability Criterion

### Part 1: 80% of the assignment grade

#### Given:

Signal flow graph representation of the system. Assume that total number of nodes and numeric branches gains are given.

#### Required:

- 1- Graphical interface.
- 2- Draw the signal flow graph showing nodes, branches, gains, ...
- 3- Listing all forward paths, individual loops, all combination of  $n$  non-touching loops.
- 4- The values of  $\Delta$ ,  $\Delta_1$ , ...,  $\Delta_m$  where  $m$  is number of forward paths.
- 5- Overall system transfer function.

### Part 2: 20% of the assignment grade

#### Given:

Characteristic equation of the system. Assume that all the coefficients of  $s^0$  to  $s^n$  are given.  
Input example:  $s^5 + s^4 + 10s^3 + 72s^2 + 152s + 240$

#### Required:

- 1- Using Routh criteria, state if the system is stable or not.
- 2- If the system is not stable, list the number and values of poles in the RHS of the s-plane.

### Notes for both parts:

Each team must submit the following:

- a- Your executables and source code (using git is preferable)
  - b- Report should include:
    - 1) Problem Statement.
    - 2) Main Features of the program and additional options if exists.
    - 3) Data Structure.
    - 4) Main modules.
    - 5) Algorithms used.
    - 6) Sample runs.
    - 7) Simple user guide.
- Use any programming language you want.
  - You can work in teams of a maximum of **Six Students**.
  - The grade of this programming assignment represents **30% of total lab part grade**, so make sure you invest the best efforts in this assignment.
  - The programming assignment period is **7 weeks**.

**Good Luck**