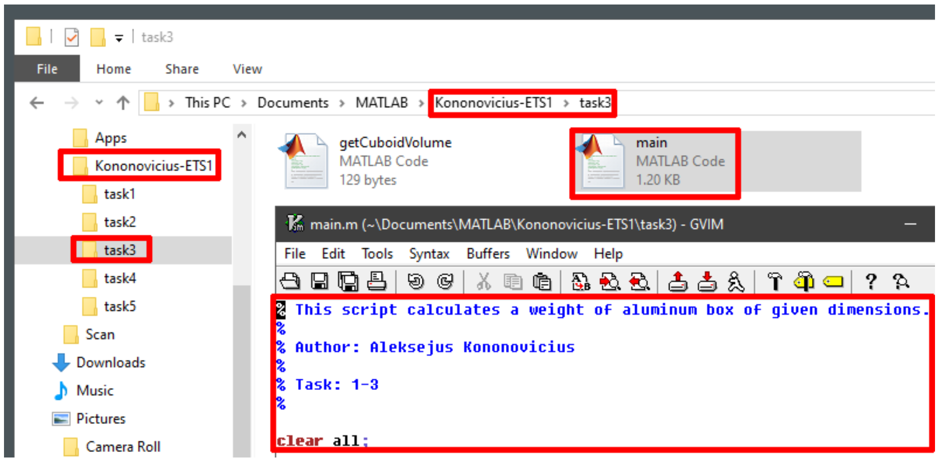
Basic Programming in Matlab (Evaluated Task Set 1)

Soft deadline: 2020-04-21 00:00:01. After this date there will be 10% penalty for each week late.

Hard deadline: 2020-05-23 00:00:01. After this date no submission will be accepted for evaluation.

Submission requirements: All of your code for this task set should be in a single folder named "Surname-ETS1" (where "Surname" is your surname), which you will submit as a single zip archive. All of your code for a particular task should be in subfolder "TaskN" (where "N" is the number of task). Each subfolder should contain file "main.m". This file should be your main script file for the task. Other files may be present as needed. "main.m" should begin with some meta information (description, author, task number). Meta information should be followed by **clear all;** command.

Due to the quarantine you will have to submit your solutions through e-learning platform. Archive all files in "Surname-ETS1" to a single zip archive (named "Surname-ETS1.zip"). Note that you might get some follow up questions before your submission is evaluated. Be sure to answer the questions promptly.



```
% This script calculates a weight of aluminum box of given dimensions.
%
% Author: Aleksejus Kononovicius
%
% Task: 1-3
%

clear all;
```

Figure 1: An example of proper submission: folders are structured as described, "main.m" file is present and contains the required meta information. The important things are highlighted.

Evaluation criteria: Is the submission on time? Does submission follow the above requirements? Is the code clear and does it follow good coding practices? Are the input prompts proper? Is the output properly formatted? How well the task is performed? How well the author can explain his code/idea/approach? Is the approach reasonable? How well the author can answer any additional questions regarding the task? Note that for this particular task set you are not required to write programs in "efficient Matlab way", but you can do that if you want.

Tasks

1. Write a Matlab program that calculates the combined resistance of the resistor network shown in Fig. 2. The user should be prompted to enter the resistances of all three resistors in Ohms. The program should print out the combined resistance in Ohms in a nicely formatted sentence.

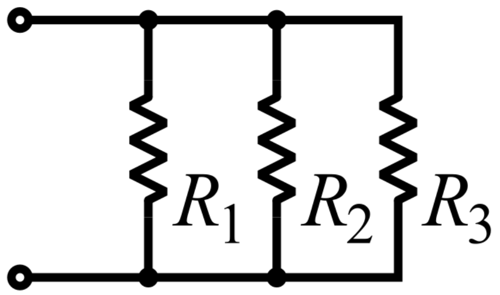


Figure 2: Network of resistors.

2. Cartesian and polar coordinate systems are two most commonly used two–dimensional coordinate systems. Write a Matlab program that converts coordinates between these coordinate systems. The user should be prompted to choose the input coordinate system and to enter coordinates. The program should print out the coordinates in the other coordinate system.

3. Write a Matlab program that calculates weight of an aluminum box (hollow cuboid) in kg (assume density of aluminum to be $2.7\,\mathrm{g/cm^3}$). The user should be prompted to enter the external measurements (height, width and length) of the box and the thickness of its walls in meters. The program should print out the weight of the box in kg in a nicely formatted sentence.

4. Write a Matlab program that searches a matrix for saddle (minimax) points. A saddle point in this case is an element of a matrix, which is larger or equal to its neighbors along one dimension (for example, row–wise), but is smaller or equal to its neighbors along the other dimension (for example, column–wise). Example of a saddle point is provided in Fig. 3 and in Eq. (1) $M_{2,2}$ is a saddle point (it is largest column–wise and smallest row–wise):

$$\mathbf{M} = \begin{vmatrix} 1 & 0.2 & 0.6 \\ 0.8 & 0.5 & 0.7 \\ 0.9 & 0.1 & 0.3 \end{vmatrix}. \tag{1}$$

   Have in mind that there may be more than one saddle point in the input matrix. Print out the coordinates of all saddle points your program finds. If none are found, print out a message "No saddle points found". The matrix should be read from a text file (provide your own, but be ready to read file provided by your instructor or be asked to generate one on the fly). Be prepared to show that any of the listed saddle points are indeed saddle points.

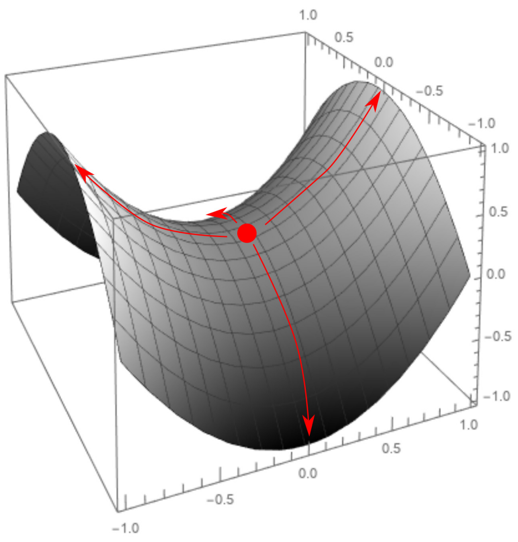


Figure 3: Saddle point of a two–dimensional function.

5. Write a Matlab program that outputs all possibilities to put $+$ or $-$ or nothing between the numbers from 1 to 9 (in ascending order) such that the result is some target number. The program should prompt the user to enter the target number. For target number 100, one of the possibilities is:

$$1 + 2 + 3 - 4 + 5 + 6 + 78 + 9 = 100. \tag{2}$$

Note that in this case we have put a lot of $+$, except between 3 and 4 where we have put $-$ and except between 7 and 8 where we have put nothing (so we get number 78 in our expression). A different example for target number 42:

$$12 - 34 + 56 + 7 - 8 + 9 = 42. \tag{3}$$