

3 Project – submit your solution to petr.kovar@vsb.cz

If you speak Czech, please submit the project to odevzdavarna with key i0jxahj.

Combinatorics

3.1. Consider a bar code containing three kinds of black stripes (thin, medium and thick) and two types of white spaces (thin and medium) as separators. Our barcode will have a fixed length of 12 black stripes and 11 white spaces. An example of such a code is depicted in Figure 1.

- a) How many different codes of this type do exist?
- b) How many different codes exist if we want to use exactly four black stripes of each width and more medium white spaces than thin spaces?



Obrázek 1: An example of a barcode.

(2 b)

3.2. Consider the barcode introduced in the first example part a). How many of these codes contain at least one stripe from each width (at least one stripe of each black stripe width, and at least one space of each white space width)?

Mind: Look for a solution for the black stripes independently on the solution for the white spaces and vice versa for the white spaces.

(3 b)

Graph Theory

3.3. Consider a graph G with degrees $\{x, 4, 3, 2, 2, 2, 2, 1, 1\}$. Which values are feasible for x so that the graph G contains at least three edge-disjoint cycles (if in graph G exist cycles that are not edge-disjoint, it does not mind)? All feasible values of x write as $x \in \{x_1, x_2, \dots, x_n\}$. Justify your answer carefully (for example by a computation) and draw at least two different graphs with such degrees, each for a different value of x .

(3 b)

3.4. Draw an euler graph G with the following entries: Number of vertices $|V| = 12$, the minimum vertex degree $\delta(G) = 2$, the maximum vertex degree $\Delta(G) = 6$. Is it possible to find G so that it will have

- a) the vertex-connectivity less than 2?
- b) the edge-connectivity smaller or equal 1?

Justify carefully your solution and in your picture of the graph denote vertices by v_1, v_2, \dots, v_{12} and write the eulerian trail (as a sequence of vertices).

If in one of the cases a), b) it is not possible to construct such a graph G satisfying all given conditions, construct at least a graph G_2 , which will include an open eulerian trail. Denote vertices by v_1, v_2, \dots, v_{12} again and write the resulting open eulerian trail (as a sequence of vertices). (2 b)

Guidelines

Write the project using a computer, include the title with your name, student ID, number of the project, year and a grading table (see the sample project). The project will contain a detailed description of your solution for each problem. If you skip a problem, mark it clearly in the text by saying „*I did not solve the problem number X*“.

Submit your project to petr.kovar@vsb.cz as an uncompressed PDF file, use your student ID in the name of your submitted file.

You will be awarded 0 upto 2 or 0 upto 3 points for each of the problems.

Submit your project no later than on **Monday 7.12.2015 at 23:59**.