

Programming Assignment No. 1

(7 points)

Topic: Data structure *QuadTree*

Deadline: see the website.

Objective: The objective of the first programming assignment is to:

1. design and implement a user interface for entering points $\mathcal{B}$,
2. write code that creates the data structure *QuadTree* $\mathcal{Q}$,
3. visualize the structure $\mathcal{Q}$ and selected operations on it and on the set of points $\mathcal{B}$.

Assignment: Implement an application that creates and visualizes the data structure *QuadTree* $\mathcal{Q}$, that stores a finite set of points $\mathcal{B}$ entered by the user and allows operations on a suitably selected subset of $\mathcal{B}$. Specifically:

- **0.5 pts** The program allows the user to enter points $\mathcal{B}$ using user-friendly controls, e.g. by clicking the mouse in the (square) drawing area. The input points $\mathcal{B}$ remain clearly marked throughout the program run. It is possible to clear the area (and therefore also $\mathcal{B}$ and $\mathcal{Q}$) using, for example, a button.
- **3.5 pts** The points are stored in the structure $\mathcal{Q}$, which the program visualizes interactively. When a point is added, the structure is modified and redrawn automatically.
- **0.5 pts** The user can, for example, use a button to generate $\mathcal{Q}$ for some (arbitrary but fixed) number of $n \in \mathbb{N}, n > 10$ randomly selected points $\mathcal{B}$.
- **1 pt** The user can select a point and view the "path" to it in the structure $\mathcal{Q}$; name the quadrants along the path as you wish, but use distinct names. Mark the selected point in a different color in this case.
Example: The path $root \rightarrow I \rightarrow III \rightarrow point$ for a point lying in the upper-right part of the axis-aligned square centered in the middle of the drawing area, with a side length equal to $1/2$ the side length of the area.
- **1.5 pts** The user can select from the set $\mathcal{B}$ a subset of points lying inside the axis-aligned rectangle $\mathcal{R}$, which is defined by clicking and dragging the mouse (e.g. using the mouse wheel). Points inside $\mathcal{R}$ and the rectangle itself are clearly distinguished, for example by changing their color (as in Fig. 1). Points inside the axis-aligned rectangle are highlighted while the mouse is being dragged.

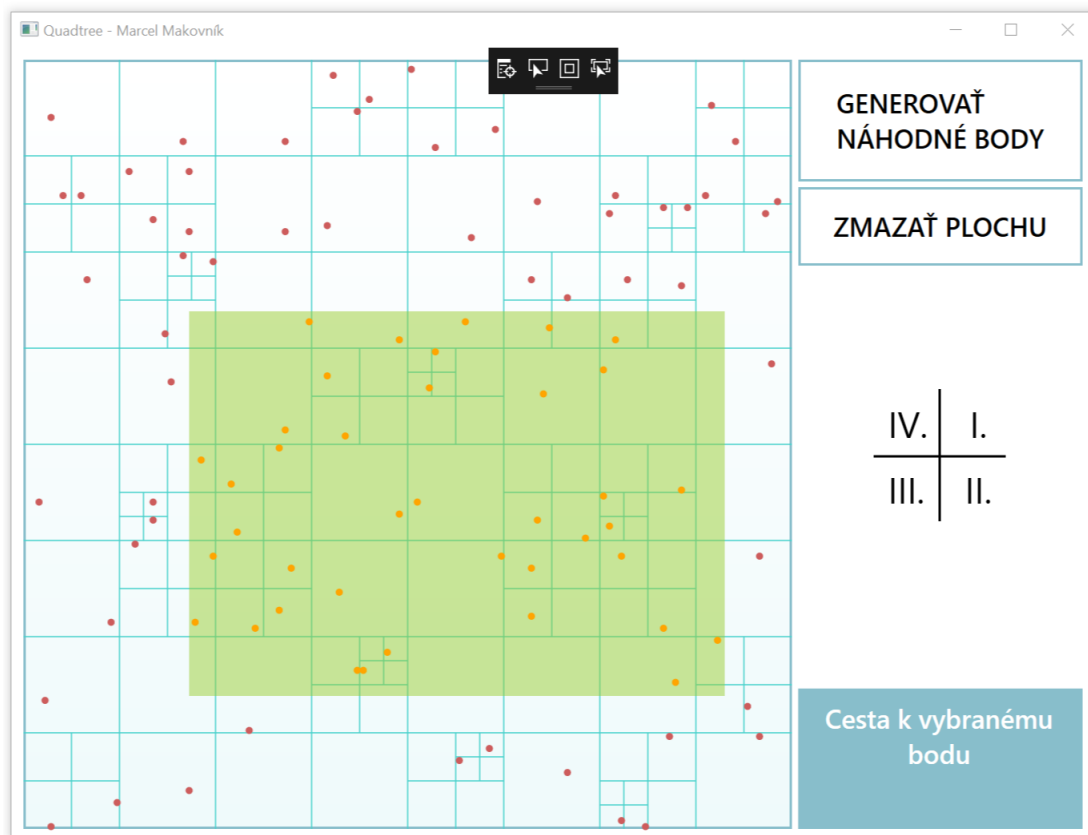


Fig. 1: Visualization of the subset of points $\mathcal{B}$ lying inside the axis-aligned rectangle $\mathcal{R}$.

Deliverables: Along with the user interface, include the code that implements your solution. This part must be easy to identify and authored by you, i.e. created specifically for this assignment. Using only external libraries is strictly forbidden!

The following are also required:

- the code must be **sufficiently** commented and **clearly** formatted. Insufficient comments and unclear formatting may incur a deduction of up to 3 points.
- Any non-intuitive controls or parts of the interface must be described in a separate `readme.txt` file.

Sample application is available on the website, along with this PDF file.