

Computer Games Exercises: 2024s s07 (non-physics)

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Answer header

Please put the author information in the header of all code files.

- `name (Name)`
- `coauthor list`

C05: Hierarchical Spatial Hashing

Preparation

Read the paper:

- M. Eitz and G. Lixu, "[Hierarchical Spatial Hashing for Real-time Collision Detection](#)," *IEEE International Conference on Shape Modeling and Applications 2007 (SMI '07)*, Minneapolis, MN, USA, 2007, pp. 61-70, doi: 10.1109/SMI.2007.18.

Read the source code of the "Hierarchical Spatial Hashing" game and understand the layout.

Task

Implement the method in the paper in 1D.

- Mapping phase
 - read the line segments as (x_{\min}, x_{\max}) from "Edit Segments" following the provided format
 - map the line segments to grid coordinates (a_{\min}, a_{\max}, l) by
$$\begin{aligned}a_{\min} &= \lfloor x_{\min}/k \rfloor \\a_{\max} &= \lfloor x_{\max}/k \rfloor \\l &= \max(\lceil \log_2(s) \rceil, 0)\end{aligned}$$
with $s = x_{\max} - x_{\min}$ and $k = 2^l$
 - show the line segments in the corresponding cells in "Grid", as shown on the left side of "Figure 1" in the paper
- Hash table
 - read the hash table size from "Edit Hash Size"
 - implement the "Algorithm 2 DJB2 hash function" in the paper for the 1D case with the cell index (a, l) and the hash table size m as the input
 - put the line segments in the hash table
 - show the complete hash table result in "Edit Hash Result" following the provided format, while there might be multiple cells and segments corresponding to the same hash value
- Intersection test
 - read the point position from "Edit Point"
 - detect the possible intersections of the point with the line segments
 - show the test result in "Edit Intersection Result" following the provided format, while only the hash table elements of the grid cells containing the point should be displayed
- Generalization
 - Whenever the input of hash table size, line segments or test point is changed, the output of hash table and intersection test should be updated.

Questions

Write the corresponding answers in the script file.

- Which criteria are used to select the hash function in the paper?
- Please create one experiment with 5 different segments. What's the behavior of the method with different hash table size, e.g. 3, 6, 12?