ADS-MIRI
Proposal of Homeworks and Final Projects
Third Update

April 22, 2020

The Homeworks and Final Projects are not limited to the following proposals and or topics. Feel free to choose any other topic or data structure of your interest.

In the case of the Final Project make a proposal to one of us –the one whose topics in the course are closest to the subject of your interest– and ask for the formal agreement from the course coordinator (A. Duch).

It might be that a few things from the published documents: *ADS-MIRI: Proposal of Homeworks and Final Projects* and *ADS-MIRI: Grading*, will have to be adapted to the novel situation. For instance, it might happen that we have to forget about oral presentations, giving the option to deliver a video lecture.

1   Homeworks

A homework is either: a) the solution of problems on `jutge.org` or b) a written document that includes:

- a short description of the data structure under study,

- its main features, an implementation of the data structure,

- the design of an experiment to show one of the features of the data structure

- a report of the results of executing the proposed experiment and

- some personal observations and or conclusions.

In case of doubt do not hesitate to ask, maybe using the new Slack channel `#projects`, or a direct Slack message or email to the professor supervising the project or homework.

1.1 Proposals from Amalia Duch's Lectures

- Show experimentally that the expected height of a randomly built binary search tree of n nodes is $\Theta(\log n)$.

- Red-Black trees

- Tim sort and Introspective sort

- k-d tries or quad tries.

- Segment trees.

- Priority search trees.

- Kinetic heap.

- Bisector trees.

- B trees.

1.2 Proposals from Conrado Martínez's Lectures

The lists below are still expanding, as we advance further in the course I expect to add a few more items.

- Cuckoo Hashing

- Coalesced Hashing

- Linear Probing (FCFS, LCFS, Ordered hashing, Robin Hood)

- Counting Bloom Filters

- Leftist Trees

- Partially or Fully Persistent Dictionary[1].

- Catenable Queues

1.3 Proposals from Salvador Roura's Lectures

The lists below are still expanding, as we advance further in the course I expect to add a few more items.

- Solve problems P62097 and/or P39399 on `jutge.org`.

- Solve problem P53274 on `jutge.org`.

- Solve problems P83997 and/or P21174 on `jutge.org`.

- Solve problems P27780 and/or P99729 on `jutge.org`.

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[1]Using some variant of search trees, e.g., red-black trees

2 Final Projects

2.1 Proposals from Amalia Duch's Lectures

- Deletion in quad trees.
- Applications of octrees in computer graphics.
- Sweep lines.
- Fractional Cascading.
- The van Emde Boas Layout.
- Cache oblivious B trees.
- Succint data structures.

2.2 Proposals from Conrado Martínez's Lectures

The list below are still expanding, as we advance further in the course I expect to add a few more items.

- Deletions in Open Addressing Hash Tables.
- Perfect Hashing & Dynamic Perfect Hashing.
- Applications & variants of Bloom Filters. Bloomier Filters.
- Double-ended Priority Queues.
- Binomial, Fibonacci & Pairing Heaps.
- Order-Maintenance Lists and Sparse Tables.
- Functional Data Structures.

2.3 Proposals from Salvador Roura's Lectures

- Solve problems P62097, P39399, P53274, P83997, P21174, P27780 and P99729 on `jutge.org`.

2.4 Other Proposals

- Do at least 5 different homeworks from the lists above.