ETH
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Programming Techniques for Scientific Simulations Exercise 7

HS 12
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Problem 7.1 Benchmarking standard containers (Block C)

We want to benchmark the time required to randomly insert and delete in the three types of containers provided by the standard library: `std::vector`, `std::list`, `std::set`.
In order to achieve this, you should:

1. Create a vector of size n, and assign incremental values to its entry, i.e. `v[i] = i`.
2. Copy the content of the vector to a `std::list` and a `std::set`.
3. For each container record the time to:
   - Insert a new element in a random position,
   - Undo the previous operation by erasing the inserted element.

By repeating the benchmarks for many system sizes, you should be able to see the cross over between such containers.
Hints:

- Make use of `std::advance` to have a generic random access iterator.
- Special treatment is required for the `std::set`.
- To record a proper time you should measure the time between k repetitions of step 3., where $k \approx 1'000'000$.

Problem 7.2 Penna Model Implementation (Block C)

Design and implement a Population class that performs all major operations on a population of animals (aging, generation of offsprings, deaths) and combine the classes into a working simulation of the Penna model.

You might start producing some plots which will be used in the final report:

- Try to reproduce the figures of the paper.
  - Plot the population number as a function of time
  - Plot the average age of death as a function of the mutation rate
- What is the distribution of bad genes in a genome at the beginning of the simulation? How does the distribution look like in the end?