

# Programming Techniques for Scientific Simulations

## Exercise 5

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### Problem 5.1 Simpson integration with function objects (Block B)

In a previous exercises, we have written a static library to perform simpson integration of  $\sin(x)$  in the region  $x \in [0, \pi]$ , where the function is passed as a pointer. In this exercise, implement the simpson integration of  $\sin(\lambda x)$  in the region  $x \in [0, \pi/\lambda]$  by the use of a function object.

1. Rewrite the `simpson` function so that it works with function objects.
2. Introduce templates for the integration boundaries `a` and `b`. What are the concepts of all templates arguments?  
What happens if you call your function like `simpson(func_obj, 5, 10, 128)`?

### Problem 5.2 Penna Model Implementation (Block C)

Attached with this exercise are two sample classes *Genome* and *Animal* found in `genome.hpp` and `animal.hpp`. Either by using these sample classes or your own classes, please

1. implement all the functions mentioned in the provided/your class headers,
2. write (a) test program(s) for the classes,
3. write a `Makefile` for building: apart from compilation of the object files for the classes create the target `test`, which (e.g. `make test`) should build the test programs.