Tasks 5 (10 points)

(a) Write down a divide and conquer algorithm for computing the integral by using the trapezoidal rule. Use pseudo-code.

(b) Implement your algorithm in C++.

A driver program main.cpp is given in the folder Templates. It implements a simple user dialog, where the user can chose one of five test cases example1 ... example5, or all cases. In the template for main function, you will find the includes

```
#include "integral.hpp"
#include "cases.hpp"
#include "intro.hpp"
```

While integral.hpp is given as a template, the other two files must be implemented by you.
The test cases must be implemented in functions example1 ... example5, where the parameter list should be void. Implement also a function intro, what prints a short manual on screen at start-up of the program.
Implement in integral.cpp the adaptive trapezoidal rule as well as the standard trapezoidal rule. The interfaces of the functions are given in the header file integral.hpp.
The examples must implement the test cases

1. $$\int_0^{\pi/2} \sin(x)\,dx.$$
2. $$\int_{-\pi/2}^{\pi/2} \cos(x)\,dx$$
3. $$\int_0^{2} \arctan(x)\,dx$$
4. $$\int_{-1}^{3} x\sin(x)\,dx$$
5. $$\int_{-2}^{2} f(x)\,dx \text{ with } f(x) = \begin{cases} 1 & x < 1 \\ x^2 & x \geq 1 \end{cases}.$$

Use tolerance $tol = 0.000001$. Use a pointer to a function as input argument for the functions (as given by the templates).

Deadline See OPAL.

What to submit For the theoretical part: Upload a PDF file with your solutions. However, to create the source for your PDF your are free to use a word processor (Word, Writer, etc.) , LaTeX, or write down your solutions on paper an scan the paper to PDF.

For the programming part: Upload a screenshot of your running program and the C++ source and header file(s) (not the entire project) online on OPAL.

Templates integral.hpp, main.cpp. This templates must be used and it is not allowed to change them.