This is the instruction for the course project: indepent study of numerical integration and numerical differentiation.

1 What is the purpose of this project?

The aim of this course project is two-folded:

- Due to limitation of time, it is impossible to cover all the topics from numerical analysis in lectures. Hence, making you studying this part can reserve more time for other topics.
- It is important to establish your ability for independent study. In fact, some topics can be understood more deeply through independent study. In think numerical integration and numerical differentiation is one of them.

2 How to write the report?

- The report is better to be written in English, like a review article (of course, Chinese report is also acceptable for the section in Chinese). There is no limitation for the number of pages.
- You report should have the following sections:
  1. Introduction;
  2. Numerical integration: try to explain the idea for numerical integration; include at least two elementary numerical integration methods and their error estimates; explain why composite numerical integration is desired sometimes. You may add whatever other topics you like.
  3. A section for numerical differentiation is desired as well.
  4. There should also be a section for the numerical experiment. In particular, solve the following integral numerically using what you learned:
  $$\int_0^1 \frac{\cos(x^{-1}\ln(x))}{x}\,dx.$$
  You need to justify that this impoper integral converges. Maybe, direct solving this integral is not a good choice. You may do transforms, or do change of variables, or do integration by parts to make it more feasible for numerical integration.

3 The percentage of each part

1. The total score will be 100. This will count towards 30% to the overall score.

2. For the grades, 70 points will be evaluated for your review part while 30 points will be for your result on the numerical example (the integral in Part 2).