

King Fahd University of Petroleum and Minerals  
College of Computer Sciences and Engineering

CISE 301 – Numerical Methods (T152)

**Programming Assignment (due date & time: Sunday 01/05/2016)**

**Total score:** 3% of the total course work score

1. Develop a program in a language of your choice to numerically integrate  $f(x) = \frac{2 \times [\sin^2(2x) + \cos(2x)]}{e^{\cos(2x)}}$  from  $x = a$  to  $x = b$ , where  $x$  is in radians, and  $a$  and  $b$  are user specified integers with  $b \geq a$  using the following two methods:

- Multiple application rule of the Trapezoid method** with equally spaced base points using  $h$  as a step size, where  $h$  is a user specified integer  $> 0$  and  $\leq (b - a)$ .
- Romberg method** with up to  $R(n, n)$ , where  $n$  is a user specified integer  $\geq 2$ .

**Use a minimum of 10 significant digits with rounding for all calculations.**

2. The program should generate the absolute true error percentage for the 2 methods above. Note that the analytical solution is

$$\int_a^b f(x) dx = \left[ \frac{\sin(2x)}{e^{\cos(2x)}} \right]_a^b$$

3. The program should generate a single table showing a comparison of all the results generated using the 2 methods above. Specifically, the table should show the result produced by the 1<sup>st</sup> method, the results  $R(n, 0)$ ,  $R(n, 1)$ , ...,  $R(n, n)$  produced by the 2<sup>nd</sup> method, and the corresponding absolute true error percentage for each result.

**Deliverables:**

- A hard copy of a report including:
  - Cover page (Name, ID, Serial number, Course, Term, Date)
  - Printout of your **well-commented** program. Write your name, ID, and serial number at the top of your program.
  - Detailed instructions on how to successfully run your program (e.g., include instructions on what compilers/tools/packages need to be installed and where to get them from, how to accept user specified values, ...).
  - Provide the single table by testing your program for the following two cases:
    - $a = 0$ ,  $b = 5$ ,  $h = 100$ ,  $n = 5$
    - $a = -10$ ,  $b = 10$ ,  $h = 1000$ ,  $n = 10$
- A soft copy of the program and the report should be included in a directory called <yourID>-prog-cise301-T152, zipped (<yourID>-prog-cise301-T152.zip or <yourID>-prog-cise301-T152.rar), and then sent by email to the instructor at [marwan@kfupm.edu.sa](mailto:marwan@kfupm.edu.sa) as well as to the grader at [s201264960@kfupm.edu.sa](mailto:s201264960@kfupm.edu.sa) with a subject line "Prog-CISE301-T152".

**IMPORTANT:** The program developed and submitted should be the result of your own individual genuine effort. I follow a zero tolerance policy regarding plagiarism.