Discussion: Homework 1

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Homework 1

- Get familiar with Unix environment
- Know how to login, edit text, run gcc, submit homework
- Implement 4 numerical integration algorithms to calculate one-dimensional integration
Integral Calculation

- Rectangle rule
- Trapezoidal rule
- Simpson’s rule
- Monte-Carlo
Rectangle Rule

- Basic idea of Riemann integral
- For each interval (STEP), we can use the value in the middle of that interval to approximate the value of the whole interval
- Thus, the definite integral of function $f(x)$ from $a$ to $b$ can be approximated by the following equation:

$$\int_{x_0}^{x_n} f(x)dx \approx \sum_{i=0}^{n-1} (x_{i+1} - x_i)f\left(\frac{x_{i+1} + x_i}{2}\right)$$

- $X_{i+1} - X_i$ : indicates the length of one interval, namely STEP
- As $\text{STEP} \to 0$, the calculated value $\to$ the definite integral of $f(x)$
Example

- $F(x) = x^3$, float result integral for interval $[0, 1]$:
  - Actual integral result $= \frac{1}{4} \times 1 - 0 = 0.25$
  - STEP=1, 0.125
  - STEP=0.5, 0.21875
  - STEP=0.3, 0.23065
  - STEP=0.1, 0.24875
  - STEP=0.05, 0.249687
  - STEP=0.01, 0.249988
  - Approaching 0.25
C files

- 4 files
  - main.c, integrate.c, integrate.h, assert.h
- assert.h
  - Defines what happens if assertion fails
  - If interested, you can try to violate one assertion and see what happens
- integrate.h
  - Defines some constant numbers: M_PI, STEP, SAMPLE_COUNT (for Monte Carlo), SEED,
  - Defines FUNCT as a pointer to a function which takes one float parameters and returns one float result. Note(*FUNCT) retrieves the content saved in pointer FUNCT; For details, google “function pointer”.
  - Declares the integral functions
C files (cont’d)

- integrate.c
  - The file you need to modify. You need to complete the 4 integral functions.

- main.c
  - Defines 3 functions which are the test functions, namely f1(), f2(), f3(). Note that we may have more test cases
  - Defines the main() function which prints out the results of the integral functions you defined with the pointer pointed to f() functions passed as parameters
Some programming issues

- Programs are written for people to understand
- Comments
  - Have some concise comments in your program to tell the readers what you are doing with the codes
  - Not only for other people who read your program, but also for yourself
- Please avoid using GOTO, just use common loops or conditional statement
Compiling and running

- **Compile**
  - `gcc integrate.c main.c -Wall -O0 -g -lm -o integrate`
  - Note here are two .c files, or some variables will not be found by gcc compiler

- **Run**
  - If in compiling session, you indicate `integrate` as the output file (`-o integrate`),
  - `./integrate`
  - `./` tells the system the file “integrate” is under current directory
Result

- Results may not be exactly the same, one possible result:
  - 3.141938
  - 3.140442
  - 3.141440
  - 3.141977
  - 0.000039
  - 0.000038
  - 0.000039
  - -0.004045
  - 0.249988
  - 0.250025
  - 0.250000
  - 0.250000
  - 0.249967
Submitting homework

- Create a folder “hw1” under your working directory
  - mkdir hw1
- Put the files in hw1
  - Don’t forget statement.txt
- Type in command:/ecelib/bin/turnin25
  - You can also view the deadline for hw1 here: Friday midnight
  - The file names and folder name should be exactly the same as here
Q&A
• About the EECS account
  • If you still cannot login to newport server, send me an email stating your name, UCINetID, student ID today

• About cse25.eecs.uci.edu
  • Student accounts have not been set up
  • We do not need to use this server for this assignment