(60-140) Lab Exercises #3

— Search for information and program with conditions

October 2, 2017

1. Understand more about RAPTOR:
   (a) Watch the full video clip about *how to work with variable*.
   (b) Watch the first half of the video clip about *how to make selections*.
2. RAPTOR: Logical expressions and `if` condition
   (a) Start RAPTOR with preloaded flowchart "l1_area.rap" (Lab #1).
   (b) Modify the flowchart to introduce a checking mechanism. The modified flowchart takes one new input as `height`, and uses it to calculate the `volume` ($v = \pi \cdot r^2 \cdot h$) of a cylinder with `radius`. It is assumed that this cylinder is tall, and therefore `height` has to be bigger than `radius`. In addition, it is required that `radius` cannot be smaller than 2. With the modification, the new flowchart prints out the volume only if the inputs satisfy the conditions. Otherwise, it prints out error messages correspondingly as shown in the following examples:
   (i) A case when `radius` is less than 2:
   ```
   Enter radius:  1.8
    Radius cannot be smaller than 2.
   ```
   (ii) A case when `height` is not bigger than `radius`:
   ```
   Enter Radius:  3
   Enter Height:  2
   Height has to be bigger than radius.
   ```
   (iii) A normal case with valid inputs:
   ```
   Enter Radius:  3
   Enter Height:  4
   The volume is 110.10.
   ```
   (c) Follow "`Help->General Help->Math in Raptor`" to get information about how to use `pi` (under `Math functions`) and exponentiation `^` (under `Math Operators`). Exponentiation has to be used in the modified flowchart to calculate r^2.
   (d) Save the modified flowchart to "l3_volume.rap", and submit it online.
3. Algorithm implementation with C programming languages:
   (a) Implement the algorithm as represented by "l3_volume.rap", and write an equivalent C program that accomplishes what the flowchart does with the following minor changes:
   - Use only one `scanf()` function to input both `radius` and `height` separated by a comma. An example is shown below:
     ```
     Enter radius and height (r,h):  3,4
     The volume is 110.10.
     ```
   - Check the Website at *C Language Library* to find out information about the build-in function `pow()`, and make sure that `pow()` is used in your impementation to calculate r^2.
   - Use "`#define M_PI 3.14159265358979323846`" to define π value as it is not predefined in C99 standard.

   (b) Save your program to a file named "`l3_volume.c`" in your working directory, and submit it online.

Evaluation: All online submissions must be completed before due time, which will be kept on record. In addition, every student is required to show/demonstrate his/her complete exercises to a GA/TA at the end of this lab, or at the beginning of the next lab after completing online submission. The demonstration includes showing the submitted flowchart and/or C codes, compiling the C program, and trying out the flowchart and C program with different input values. The maximum marks for this lab is 15, with 10 for the lab work (submission and demonstration) and 5 for lab attendance.