

Practice Exercise #03: Washers

http://www.comp.nus.edu.sg/~cs1020/4_misc/practice.html

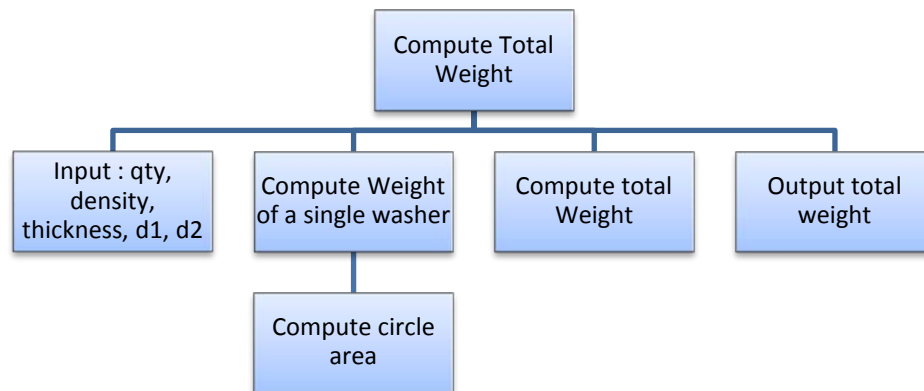
Reference: Week 1 Java Basics

Objectives:

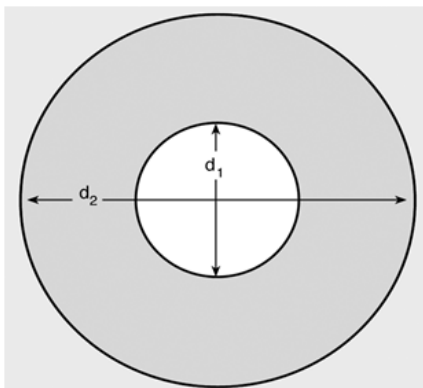
1. Converting a simple C program to Java program
2. Using **Math** class
3. Writing user-defined method

Task statement:

In CS1010 Week 3 example 3[†], we calculate the total weight of washers. The structure chart is shown below.



The rim area of a washer is the difference between the area of the outer circle and the area of the inner hole:



$$\text{rim area} = \pi(d_2/2)^2 - \pi(d_1/2)^2$$

[†] Lecture slides for CS1010 are available on http://www.comp.nus.edu.sg/~cs1020/4_misc/cs1010_lect.html

The C program and Python program are given below. Both programs are available on the "CS1020" → "Miscellaneous" → "Practice Exercises" web page.

```
// Compute total weight of a batch of washers
#include <stdio.h>
#include <math.h>
#define PI 3.14159

double circle_area(double);

int main(void) {
    double d1,           // hole circle's diameter
           d2,           // big circle's diameter
           thickness,
           density;
    int    qty;

    double unit_weight, // single washer's weight
           total_weight, // a batch of washers' total weight
           rim_area;    // single washer's rim area

    printf("Inner diameter in cm: ");
    scanf("%lf", &d1);
    printf("Outer diameter in cm: ");
    scanf("%lf", &d2);
    printf("Thickness in cm: ");
    scanf("%lf", &thickness);
    printf("Density in grams per cubic cm: ");
    scanf("%lf", &density);
    printf("Quantity: ");
    scanf("%d", &qty);

    // compute weight of a single washer
    rim_area = circle_area(d2) - circle_area(d1);
    unit_weight = rim_area * thickness * density;

    // compute weight of a batch of washers
    total_weight = unit_weight * qty;

    printf("Total weight of %d washers is %.2f grams.\n",
           qty, total_weight);

    return 0;
}

double circle_area(double diameter) {
    return pow(diameter/2, 2) * PI;
}
```

```

# washers_v2.py
# Compute total weight of a batch of washers

import sys, math
PI = 3.14159

# main function
def main():
    d1 = float(raw_input("Inner diameter in cm: "))
    d2 = float(raw_input("Outer diameter in cm: "))
    thickness = float(raw_input("Thickness in cm: "))
    density = float(raw_input("Density in grams per cubic cm: "))
    qty = int(raw_input("Quantity: "))

    # compute weight of a single washer
    rim_area = circle_area(d2) - circle_area(d1)
    unit_weight = rim_area * thickness * density

    # compute weight of a batch of washers
    total_weight = unit_weight * qty

    print "Total weight of %d washers is %.2f grams." % (qty,
total_weight)

# Compute area of a circle given its diameter
def circle_area(diameter):
    return pow(diameter/2, 2) * PI

# Runs the main method
if __name__ == "__main__":
    main()
    sys.exit(0)

```

Convert the program into a Java program **Washers.java**.

You are to use appropriate method(s) in the **Math** class, and also include a user-defined class method **circleArea()** to compute the area of a circle.

You do not need to define your own constant for π , as the **Math** class already has such a constant for you to use. Check out the API.

Sample runs:

Inner diameter in cm: 12.3

Outer diameter in cm: 23.4

Thickness in cm: 3.5

Density in grams per cubic cm: 2.4

Quantity: 23

Total weight of 23 washers is 60129.58 grams.

Inner diameter in cm: 20

Outer diameter in cm: 25

Thickness in cm: 2.1

Density in grams per cubic cm: 3.7

Quantity: 100

Total weight of 100 washers is 137307.23 grams.