C212/A592 Lab 4

Intro to Software Systems

Objectives:

- Using Conditional Statements
- Using a loops

Lab instructions

1. Roman numbers: Write a program that converts a positive integer into the Roman number system. The Roman number system has digits

I	1
V	5
X	10
L	50
C	100
D	500
M	1,000

   Numbers are formed according to the following rules:

   a) Only numbers up to 3,999 are represented.
   b) As in the decimal system, the thousands, hundreds, tens, and ones are expressed separately.
   c) The numbers 1 to 9 are expressed as

I	1	IV	4	VII	7
II	2	V	5	VIII	8
III	3	VI	6	IX	9

   As you can see, an I preceding a V or X is subtracted from the value, and you can never have more than three I's in a row.

   d) Tens and hundreds are done the same way, except that the letters X, L, C and C, D, M are used instead of I, V, X, respectively.

   Your program should take an input, such as 1978, and convert it to Roman numerals, MCMLXXVIII.

2. A minivan has two sliding doors. Each door can be opened by either a dashboard switch, it's inside handle, or its outside handle. However, the inside handles do not work if a child lock switch is activated. In order for the sliding doors to open, the gear shift must be in park, and the master unlock switch must be activated.

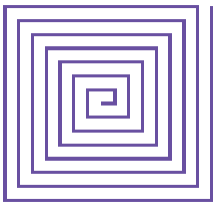
   Your task is to simulate a portion of the control software for the vehicle. The input is a sequence of values for the switches and the gear shift, in the following order:

- Dashboard switches for left and right sliding door, child lock, and master unlock (0 for off or 1 for activated)
- Inside and outside handles on the left and right sliding doors (0 or 1)
- The gear shift setting (one of P N D 1 2 3 R).

A typical input would be 0 0 0 1 0 1 0 0 P.

Print “left door opens” and/or “right door opens” as appropriate. If neither door opens, print “both doors stay closed”.

3. Write a graphical application that draws a spiral, such as this one:



4. The Buffon Needle Experiment: The following experiment was devised by Comte Georges-Louis Leclerc de Buffon (1707–1788), a French naturalist. A needle of length 1 inch is dropped onto paper that is ruled with lines 2 inches apart. If the needle drops onto a line, we count it as a hit. (See Figure on the left.) Buffon discovered that the quotient tries/hits approximates π.

For the Buffon needle experiment, you must generate two random numbers: one to describe the starting position and one to describe the angle of the needle with the x-axis. Then you need to test whether the needle touches a grid line.

Generate the lower point of the needle. Its x-coordinate is irrelevant, and you may assume its y-coordinate *ylow* to be any random number between 0 and 2. The angle α between the needle and the x-axis can be any value between 0 degrees and 180 degrees (π radians). The upper end of the needle has y-coordinate

$$y_{\text{high}} = y_{\text{low}} + \sin\alpha$$

The needle is a hit if *yhigh* is at least 2, as shown in Figure on the right. Stop after 10,000 tries and print the quotient tries/hits. (This program is not suitable for computing the value of π. You need π in the computation of the angle.)

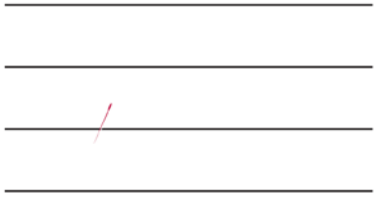


Figure
The Buffon Needle Experiment

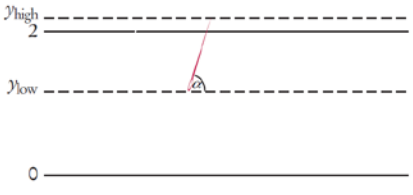


Figure
A Hit in the Buffon Needle Experiment