Lab 01: C Fundamentals

CSE 4108

Structured Programming I Lab

August 2022

Lab Tasks

1. **Printing Tick:**

Write a program that uses **printf** to display the following picture on the screen:

```
     *
    *
   *
*   *
 * *
  *
```

2. **Volume of a Sphere:**

The volume of a sphere is calculated by:

$$V = \frac{4}{3}\pi r^3$$

where r is the radius of the sphere.
Write a C program that computes the volume of a sphere with a 20-meter diameter. Use π= 3.14159.

Hint:

- Write the fraction $\frac{4}{3}$ as 4.0f/3.0f. (Try writing it as 4/3. What happens then?)
- C doesn't have an exponentiation operator, so you'll need to multiply ***r*** by itself twice to compute r^3.

3. **Ask Radius:**

Modify the program written in the last task so that it prompts the user to enter the radius of the sphere.

4. **Value Added Tax:**

Bvaly is a multinational business venture that focuses on e-commerce. To cover the maintenance cost, they charge 5% VAT for any item purchased. For example: If you buy a product worth $100.00, you have to pay $105.00 (including VAT). They have hired you to automate the process of calculating the amount a customer needs to pay. Write a C program that asks the user to ender the dollar-and-cents amount, then displays the amount with 5% VAT added.

Sample run:

Enter an amount: 100.00
With VAT added: 105.00

Note that, underlined value denotes user input.

5. **Polynomial Evaluation:**

Write a C program that asks the user to enter the value of x and outputs the value of the following polynomial:

$$3x^5 + 2x^4 - 5x^3 - x^2 + 7x - 6$$

Hint: C doesn't have an exponentiation operator, so you'll need to multiply ***x*** by itself repeatedly in order to compute the power of ***x***. (For example: ***x*x*x*** is ***x*** cubed)

6. **Horner's Rule:**

Modify the program of the last task so that the polynomial is evaluated using the following formula:

$$((((3x + 2)x - 5)x - 1)x + 7)x - 6$$

Note that the modified program performs fewer multiplications. This technique for evaluating polynomials is known as *Horner's Rule*.

7. **Counting Denominations:**

Convenience Delivery Store(CDS) of Imperial University of Tokyo (IUT) is a retail business that stocks a range of everyday items such as snack foods, confectionery, soft drinks, toiletries, etc. As the university houses international students, the store accepts **$** as payment currency. Everyday numerous students get their daily goods from CDS. After purchasing an item, whenever a student gives a note of large denomination (like $500 for example), the owner of the shop Mr. Sakamoto faces a huge problem. He can easily calculate the amount to be returned.
But he doesn't know how to pay that amount using the smallest number of denominations.
Mr. Sakamoto knows you're a great programmer and asked for your help. You need to write a program that takes the U.S. dollar amount as input and then shows how to pay that amount using the smallest number of **$20**, **$10**, **$5**, and **$1** bills.

Mr. Sakamoto has assured you that he will not enter any fractional value as input.
Sample run:

```
Enter a dollar amount: 93
$20 bills: 4
$10 bills: 1
$5 bills: 0
$1 bills: 3
```

Hint: Divide the amount by **20** to determine the number of **$20** bills needed, and then reduce the amount by the total value of the **$20** bills. Repeat for the other bill sizes. Be sure to use integer values throughout, not floating-point numbers.

8. **Leave Me A Loan:**

ABC Bank Ltd. provides loans to its customers. The customers return the amount by a fixed monthly payment. On each month however, the remaining balance is incremented by the interest rate assigned for each customer. The total balance at the end of each month can be
calculated using the following formula:
currBalance = prevBalance - pay + (prevBalance × rate)

Here,
currBalance = Updated Balance
prevBalance = Previous Balance
pay = Monthly Payment
rate = Monthly Interest Rate

Your task is to write a program that calculates the remaining payable amount on a loan after
the first, second, and third monthly payment.

Your program will take the loan amount, yearly interest rate, fixed monthly payment as input.
You need to display each balance with two digits after the decimal point.
Sample Run:

Enter amount of loan: 20000.00
Enter interest rate: 6.0
Enter monthly payment: 386.66

Balance remaining after first payment: $19713.34
Balance remaining after second payment: $19425.25
Balance remaining after third payment: $19135.71

Hint: To find the monthly interest rate, convert the interest rate entered by the user to a
percentage and divide it by **12**.