

Iterative(Loop) Statements

4.1 Objectives

1. To know the importance of the loops.
2. To understand loops (loops with/without nesting).

Time-span: 2 lab days (4 hrs.)

4.2 Problems

The students are informed to draw **flowcharts** before implementing the following problems in C.

1. Display the multiplication table of a number n up to t times. Ask the user if he/she wants to repeat and perform accordingly.

Sample Output:

Enter a number: 3

How many times: 5

3 * 1 = 3

3 * 2 = 6

3 * 3 = 9

3 * 4 = 12

3 * 5 = 15

2. Display the prime numbers between m and n , where $m \leq n$.

The sample output looks like:

Enter m and n: 3 20

The prime numbers are: 3 5 7 11 13 17 19

3. We know from calculus that the integral $\int_a^b f(x)dx$ gives the area between the curve $y = f(x)$ and the X-axis from the point $x = a$ to $x = b$.

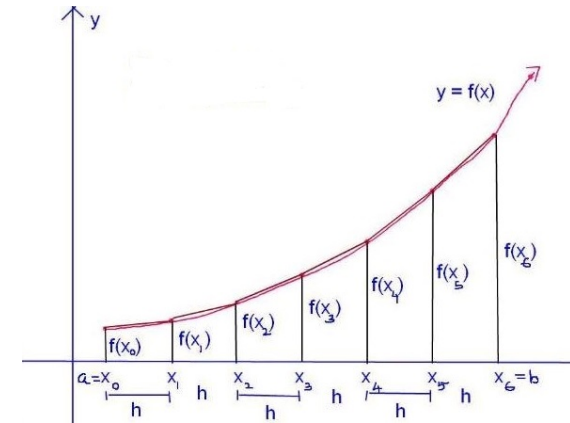


Figure 4.1: Illustrating the concept of integration

Fig. 4.1 illustrates the basic concept of integration. The idea is to find the sum of the areas of the rectangular strips. We get more accurate value of the integral by making the strips thinner and thinner.

Write a program to evaluate $\int_1^5 (x^2 + x)dx$. (You should verify the output of program by manually comparing it with the actual value of the integral).

4. The following example illustrates a crude method of factorizing integers. The example shows the details of the method that factorizes an integer number 60.

Steps	Output
1. 2 divides 60, quotient 30	2

2. 2 divides 30, quotient 15	2 2
3. 2 does not divide 15	2 2
4. 3 divides 15, quotient 5	2 2 3
5. 4 does not divide 5	2 2 3
6. 5 divides 5, quotient 1	2 2 3 5
Stop, the quotient is 1.	2 2 3 5

Write a C program to factorize a given integer number.

5. Suppose you are doing census near your residential area. You need to calculate the number of people falling on various age categories as shown below.

Category	Age Range
1. Baby	Age ≤ 12
2. Teenager	13 ≤ Age ≤ 19
3. Youth	20 ≤ Age ≤ 39
4. Mature	40 ≤ Age ≤ 60
5. Old	Age > 60

Assume the total number of people in your locality is **N**. Write a computer program to count the number of people fall in above categories. Also display the age of the oldest and youngest person.

6. We can approximate the value of π using the following Gregory and Leibniz's formula.

$$\pi = 4 \left(\sum_{k=0}^{\infty} \frac{(-1)^k}{2k+1} \right)$$

Write a C program to approximate the value of π using the above infinite series. Since the series is infinite, limit the computation up to **n** terms.

7. (a) Given an array of numbers, write a program to print the numbers in that array ignoring the repetition. For example, if the input array is {5, 6, 3, 5, 6, 8, 5, 3, 2, 2}, then the output should be 5, 6, 3, 8, 2.
 (b) Given an array of numbers, write a program to print the frequency of each number in that array. Sample output:

Enter array: 5 6 3 5 6 8 5 3 2 2

Frequency of 5 is 3.

Frequency of 6 is 2.

Frequency of 3 is 2.

Frequency of 8 is 1.

Frequency of 2 is 2.

- (c) In your statistics course, you learned about mode. The mode of a set of **n** numbers is the number whose repetition is largest. For example the mode of the set {5, 6, 3, 5, 6, 8, 5, 3, 2, 2} is 5. Write a program to calculate the mode of **n** numbers.
