



How This Course Will be Conducted

MSCM1053 COMPUTATIONAL MATHEMATICS

Problem-Solving Methodology

- ▶ Problem solving is a key part of not only engineering courses, but also for courses in computer science, mathematics, physics and chemistry.
- ▶ The methodology consist of five steps:
 1. State the problem clearly
 2. Describe the input and expected output of the problem
 3. Work the problem by hand (or with small data set)
 4. Develop a solution and convert it to a computer program
 5. Test the solution with a variety of data

Example: Computing the distance between two points in a plane.

1. PROBLEM STATEMENT

It is extremely important to give a clear, and concise problem statement to avoid any misunderstanding.

Compute the straight-line distance between two points in a plane.

2. INPUT/OUTPUT DESCRIPTION

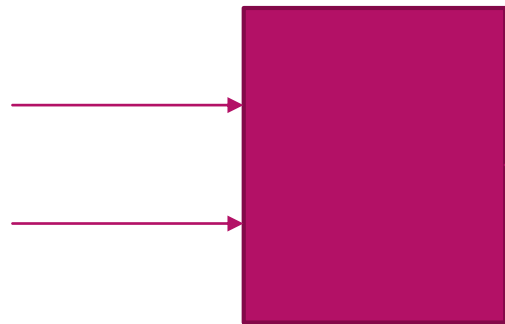
*Describe the information, or data values that are required to solve the problem.
Each of these values correspond to an object in C++.*

A diagram that shows the input and output is useful.

Input

Point 1

Point 2



Output

Distance between points

3. HAND EXAMPLE

This is a very important step and should not be skipped because if you cannot take a simple set of numbers and compute the output, it means you that you are not ready to move on to the next step.

Let the points P1 and P2 have the following coordinates:

P1=(1, 5), P2=(4,7)

Therefore, by the Pythagorean theorem,

$$\begin{aligned}\text{distance} &= \sqrt{(\text{side1})^2 + (\text{side2})^2} \\ &= \sqrt{(4 - 1)^2 + (7 - 5)^2} \\ &= 3.61\end{aligned}$$

4. ALGORITHM DEVELOPMENT

Once you can work the problem by hand/with simple data, you are now ready to outline the step-by-step solution in details. Basically, the instructions to your computer program later on.

Algorithm:

1. Give values to the two points
2. Compute the lengths of the two sides of the right triangle
3. Compute the distance between two points
4. Print the distance between the two points

C++ coding:

```
#include<iostream>
```

```
#include<cmath>
```

```
using namespace std;
```

```
int main( )
```

```
{
```

```
    double x1=1, y1=5, x2=4, y2=7, side1, side2, distance;
```

```
    side1=x2-x1;
```

```
    side2=y2-y1;
```

```
    distance=sqrt(side1*side1+side2*side2);
```

```
    cout<<"The distance between two points is" << distance<<endl;
```

```
    return 0;
```

```
}
```



5. TESTING

The final step to the problem-solving process is testing the solution (validation).

Run the program and see whether the output matches the value that has been calculated by hand.

Once the solution is validated, we should test it with a different set of data to be sure that the solution works for other valid sets of data