

Data Structures and Algorithms

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Session: Motivation for Data Structures and Algorithms

Another Example Program

- Read a triangle and output its area

```
#include <iostream>
using namespace std;
struct point {
    float x,y;
};
struct triangle{
    point p[3];
};
```

Area of a Triangle

```
void read_point(point &p) {  
    cin >> p.x >> p.y;  
}  
  
void read_triangle(triangle &t) {  
    read_point(t.p[0]);  
    read_point(t.p[1]);  
    read_point(t.p[2]);  
}
```

Area of a Triangle



```
float area(triangle t) {  
    return 0.5*abs((t.p[1].x-t.p[0].x)*(t.p[2].y-  
    t.p[0].y)-(t.p[2].x-t.p[0].x)*(t.p[1].y-t.p[0].y));  
}  
  
int main() {  
    triangle t;  
    read_triangle(t);  
    cout << area(t) << endl;  
}
```

Data Structures



- This program uses several data structures
- No **built-in** data structure for triangles
- C++ gives ways of defining our own data structures for different objects.
- The **built-in** data structure `float` is used to represent the value of a coordinate
- A point represented by its x and y coordinates
- A triangle represented by an array of 3 points

Algorithm



- The program uses 4 functions
- A function to read a point and another to read a triangle
- A function that computes the area of a triangle
- The main function that reads a triangle and outputs its area
- No **built-in** functions available for these
- Need to define our own functions or algorithms for these

Building Data Structures and Algorithms



- Identify the data structures and algorithms needed to solve the given problem
 - Data structure : triangle
 - Algorithm : compute area of triangle
- Need other data structures for this
- A triangle is a set of 3 points
 - Data structure for point
- Need other algorithms
 - Input/Output of triangles and points

Building Data Structures and Algorithms



- Define our own types of variables to implement required data structures
- Define our own functions to implement the required algorithms
- Many different implementations may be possible for the same data structure or algorithm

Exercises



- Find an alternative data structure for triangles
- Find a different formula for computing the area of a triangle
- Write a program that takes two triangles as input and determines if they have a point in common