PROGRAMMING WITH C++

LAB 4

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MATHEMATICAL FUNCTIONS

C++ provides many useful functions in the **cmath** header for performing common mathematical functions.

The link is:
http://www.cplusplus.com/reference/cmath/

function

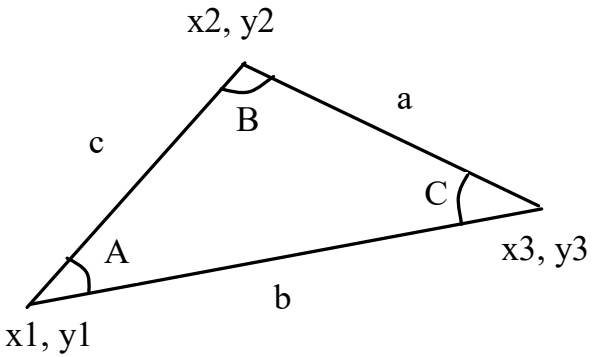
abs

<cmath> <ctgmath>

C++98 | C++11

```
     double abs (double x);
      float abs (float x);
long double abs (long double x);
     double abs (T x);           // additional overloads for integral types
```

Question 1: Computing Angles of a Triangle




```
A = acos((a * a - b * b - c * c) / (-2 * b * c))
B = acos((b * b - a * a - c * c) / (-2 * a * c))
C = acos((c * c - b * b - a * a) / (-2 * a * b))
```

Write a program that prompts the user to enter the x- and y-coordinates of the three corner points in a triangle and then displays the triangle's angles.

```
#include <iostream>
#include <cmath>
using namespace std;
int main()
{
  // Prompt the user to enter three points
  cout << "Enter three points: ";
  double x1, y1, x2, y2, x3, y3;
  cin >> x1 >> y1 >> x2 >> y2 >> x3 >> y3;
  // Compute three sides
  double a = sqrt((x2 - x3) * (x2 - x3) + (y2 - y3) * (y2 - y3));
  double b = sqrt((x1 - x3) * (x1 - x3) + (y1 - y3) * (y1 - y3));
  double c = sqrt((x1 - x2) * (x1 - x2) + (y1 - y2) * (y1 - y2));
  // Obtain three angles in radians
  double A = acos((a * a - b * b - c * c) / (-2 * b * c));
  double B = acos((b * b - a * a - c * c) / (-2 * a * c));
  double C = acos((c * c - b * b - a * a) / (-2 * a * b));
  // Display the angles in degress
  const double PI = 3.14159;
  cout << "The three angles are " << A * 180 / PI << " "
      << B * 180 / PI << " " << C * 180 / PI << endl;
  return 0;
}
```

Question 2: Converting a Hexadecimal Digit to a Decimal Value

```
#include <iostream>
#include <cctype>
using namespace std;
int main()
{
  cout << "Enter a hex digit: ";
  char hexDigit;
  cin >> hexDigit;
  hexDigit = toupper(hexDigit);
  if (hexDigit <= 'F' && hexDigit >= 'A')
  {
    int value = 10 + hexDigit - 'A';
    cout << "The decimal value for hex digit "
      << hexDigit << " is " << value << endl;
  }
  else if (isdigit(hexDigit))
  {
    cout << "The decimal value for hex digit "
      << hexDigit << " is " << hexDigit << endl;
  }
  else
  {
    cout << hexDigit << " is an invalid input" << endl;
  }
  return 0;
}
```

Question 3: Revising the Lottery Program Using Strings

Randomly generates a lottery of a two-digit number, prompts the user to enter a two-digit number, and determines whether the user wins according to the following rule:

- If the user input matches the lottery in exact order, the award is $10,000.
- If the user input matches the lottery, the award is $3,000.
- If one digit in the user input matches a digit in the lottery, the award is $1,000.

Question 3: Revising the Lottery Program Using Strings

```
#include <iostream>
#include <string> // for using strings
#include <ctime> // for time function
#include <cstdlib> // for rand and srand functions
using namespace std;
int main() {
  string lottery;
  srand(time(0));
  int digit = rand() % 10; // Generate first digit
  lottery += static_cast<char>(digit + '0');
  digit = rand() % 10; // Generate second digit
  lottery += static_cast<char>(digit + '0');
  // Prompt the user to enter a guess
  cout << "Enter your lottery pick (two digits): ";
  string guess;
  cin >> guess;
  cout << "The lottery number is " << lottery << endl;
  // Check the guess
  if (guess == lottery)
    cout << "Exact match: you win $10,000" << endl;
  else if (guess[1] == lottery[0] && guess[0] == lottery[1])
    cout << "Match all digits: you win $3,000" << endl;
  else if (guess[0] == lottery[0] || guess[0] == lottery[1]
       || guess[1] == lottery[0] || guess[1] == lottery[1])
    cout << "Match one digit: you win $1,000" << endl;
  else
    cout << "Sorry, no match" << endl;
  return 0; }
```

Question 4: Simple File Output

To write data to a file, first declare a variable of the **ofstream** type:

```
ofstream output;
```

To specify a file, invoke the **open** function from **output** object as follows:

```
output.open("numbers.txt");
```

Optionally, you can create a file output object and open the file in one statement like this:

```
ofstream output("numbers.txt");
```

To write data, use the stream insertion operator (<<) in the same way that you send data to the **cout** object. For example,

```
output << 95 << " " << 56 << " " << 34 << endl;
```

```
#include <iostream>
#include <fstream>
using namespace std;

int main()
{
  ofstream output;

  // Create a file
  output.open("numbers.txt");

  // Write numbers
  output << 95 << " " << 56 << " " << 34;

  // Close file
  output.close();

  cout << "Done" << endl;

  return 0;
}
```

Question 5: Simple File Input

To read data from a file, first declare a variable of the **ifstream** type:

```
ifstream input;
```

To specify a file, invoke the **open** function from **input** as follows:

```
input.open("numbers.txt");
```

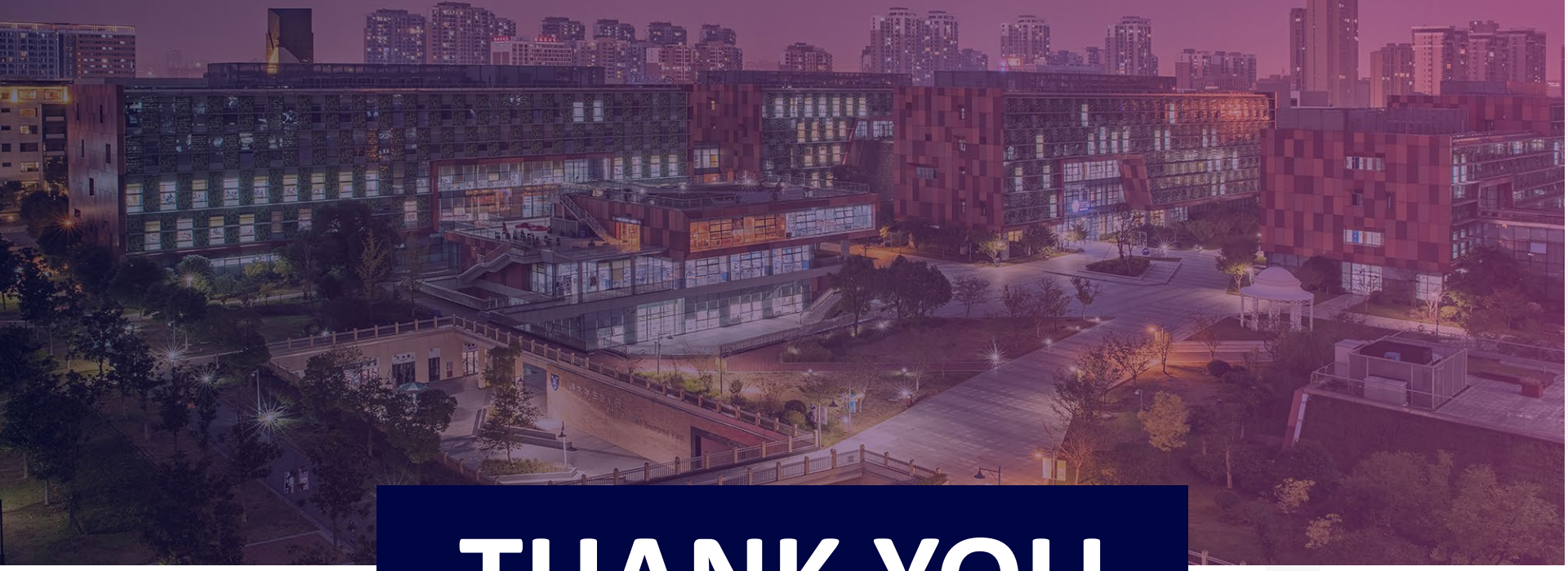
Optionally, you can create a file output object and open the file in one statement like this:

```
ifstream input("numbers.txt");
```

To read data, use the stream extraction operator (>>) in the same way that you read data from the **cin** object. For example,

```
input << score1 << score2 << score3;
```

```
#include <iostream>
#include <fstream>
using namespace std;

int main()
{
  ifstream input;

  // Open a file
  input.open("numbers.txt");

  int score1, score2, score3;

  // Read data
  input >> score1;
  input >> score2;
  input >> score3;

  cout << "Total score is " << score1 + score2 + score3 << endl;

  // Close file
  input.close();

  cout << "Done" << endl;
  return 0;
}
```



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