Exercise IV – Formats and File Input and Output

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Outline

- Review exercise three
- Exercise four goals
- Summarize lecture material on formats and file input and output
- Outline tasks for exercise four
- Review for quiz in laboratory on Thursday covering exercises 1-3 (pp 1-106 of text; homework to February 21)

Review Exercise Three

- Saw various ways in which type conversion occurs and use of mod (%) operator
- Learned how to translate mathematical equations into C++ statements
- Wrote programs using mathematical functions `atan` and `sqrt`
- Used symbolic constants

More on Exercise Three

- Use meaningful variable names
  - R, r, or radius, but not x
  - pi, or PI but not y (p?)

$$a = \frac{w+x}{y-z} \qquad b = \frac{z}{x}\frac{w-x}{2y} \qquad c = \frac{w-\dfrac{x}{y}}{\dfrac{z}{x}+wy}$$

```
a = ( w + x ) / ( y - z )
b = z / x * ( w - x ) / ( 2 * y )
c = ( w - x / y ) / ( z / x + w * y )
```


Exercise Four Goals

- As a result of this exercise you should be able to accomplish the following:
  - write output commands using format manipulators `fixed`, `scientific`, `setw(w)`, and `setprecision(p)` to print an aligned table
  - write statements to get input from and write data to files
  - write statements that combine file input and output with formatting

Formatting Output

- Default output
  - up to six significant figures
  - fixed or scientific determined automatically
- Format requires #include <iomanip>
- Have manipulators in output commands
  - `fixed/scientific` set appearance
  - `setprecision(p)` for number of digits
  - `setw(w)` for width of output

More Formatting

- See text for other manipulators
- Format manipulators appear in output statements using the << operator
  - cout << setw(10) << x;
  - cout << setprecision(6) << setw(8) << x;
  - cout << setw(10) << x << setw(10) << y;
- setw(w) is in effect for one variable only
- Other manipulators in effect until changed

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setprecision(p)

- For default output (i.e. only using setprecision) p specifies number of significant figures
- If the fixed or scientific manipulators are in effect, p specifies the number of places after the decimal point
  - double z = 123.45678;
  - cout << setprecision(5) << z;
  - cout << fixed << setprecision(3) << z;
  - First gives 123.46; second gives 123.457

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Input and Output Files

- Requires #include <fstream>
- Files have a name on the operating system and a program variable name
- Associate the two file names as follows
  - ofstream outFile("asm4.out"); // for output
  - ifstream inFile("mydata.dat"); // for input
- Use program variable name to read from or write to file

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File Example

```
ifstream iFile("myInput.txt");
ofstream out("prog.1");
double x, y;
iFile >> x >> y;
double z = sqrt( x * x + y * y );
out << "        x          y          z";
out << fixed << setprecision(4) <<
  setw(10) << x << setw(10) << y <<
  setw(10)  << z;
```

Operating system names

Program variable names

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Accessing Files

- Access file from any windows program using operating system file name
- Use Visual C++ to create input files and view output files
- Input files must be in project folder
- To display available output files, select "All Files" from the pulldown menu next to files of type in the Open menu

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Tasks for Exercise Four

- One – copy and paste code with various formats; run and study results
- Two – Modify task one code to get different output formats
- Three – copy and paste code with file input and output; run and study results
- Four – Modify task three data file and code for new input data and output formats

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Task One and Two Data

```
double x1 = 123.45678, y1 =
  -98.76543, z1 = 1413.746352;
double x2 =  23.45321, y2 =
  -8.7,z2 = 3.745;
double x3 =  1.23e-16, y3 =
  -5.3245e22,z3 = 938457483e-3;
```

- Change `y3 = -5.3245e22` to `y3 = -5.3245e-2` for task two

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Task One Code Extract

```
cout << setprecision(7);
cout << "\nx1 = " << setw(9) << x1
     << ",  y1 = " << setw(12) << y1
      << ", z1 = " << setw(7) << z1;
cout << "\nx2 = " << setw(9) << x2
     << ",  y2 = " << setw(12) << y2
      << ", z2 = " << setw(7) << z2;
cout << "\nx3 = " << setw(9) << x3
     << ",  y3 = " << setw(12) << y3
      << ", z3 = " << setw(7) << z3;
```

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Task Two Background

- Example of formats for table output

```
13.625bbb12.8bbbb-6.2
b1.200bb-78.6bbb132.5
b0.010bbb-6.4bbbb12.8
```

```
cout << fixed << setprecision(3) <<
  setw(6) << x1 << setprecision(1) <<
  setw(7) << y1 << setw(8) << z1 << endl
  << setprecision(3) << setw(6) << x2 <<
  setprecision(1) << setw(7) << y2 <<
  setw(8) << z2 <<endl<< setprecision(3)
  << setw(6) << x3 << setprecision(1) <<
  setw(7) << y3 << setw(8) << z3;
```

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Task Two is Printing Table

- Task two output from exercise instructions

```
No.bbbxbvaluebbbybvaluebbbzbvalue
b1bbbbb123.46bbbb-98.77bbb1413.75
b2bbbbbb23.45bbbbb-8.70bbbbbb3.75
b3bbbbbbb0.00bbbbb-0.05b938457.48
```

- Is output fixed or scientific?
- How to print header and first column?
- How many decimals or significant figures?
- What are column spacings for setw?

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Task Three: File Input/Output

- To get data file, select Add New Item from Project menu and select text file
- Name file `data.in`
- Copy data from assignment to file
- No screen output after execution
- Open output file, `results.out`, with Open from File menu and select all files
- Operating system file names set in `ifstream` and `ofstream` statements

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Task Four Steps

- Modify data file (external to program) and save with new name
  - Can do by calculator or by using Excel
- Modify symbolic constants in code
- Modify code to produce output table as shown in instructions
- Print output to both a file and to the screen in same program
- Change output file name

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Using Excel to Modify Data

- See instructions in notes
- Demonstration following presentation
- General process
  - Copy from C++ input or output file to Excel
  - Select T**e**xt to columns command from **D**ata menu and follow wizard instructions
  - Manipulate data as required in Excel
  - Copy from Excel and paste into Visual C++

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Reminder on Basics

- Start Visual C++.Net with new project
- Remember to select empty project!
- Define source file for programs (4.cpp)
- Define submission file (4.txt)
- For tasks three and four define input data files and open output files after program is complete
- For file output screen will only display `Press any key to continue`

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Quiz Review

- Thirty minutes – no computer use
- Use of cin and cout
- Basic program structure
- Writing correct equations
- Results of operations on data types
- Sequential program execution
  - Get input before doing calculations
  - Complete calculations before output

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