

The following example is a simple payroll program that illustrates most of the core elements of the C++ language covered in sections 3 through 6 of the course notes. During the term, a formal specification of the program will be available via the course Website:

`courses.cs.vt.edu/~cs1044/`

Sample input and output files:

```
3175 45 7597.43 B McCoy, Leonard
5328 47 3000.00 D Checkov, Pavel
3236 35 3897.89 B Sulu, Hikaru
2334 49 2089.10 D Riley, Kevin
5315 73 9336.00 B Kirk, James
7641 58 5409.12 D Uhura
7077 23 1001.00 B Rand, Janice
4098 32 8594.98 D Spock
3424 39 2999.99 B Solo, Han
4297 52 1000.00 B Chewbacca
1716 53 2011.50 D Skywalker, Luke
5956 67 5245.42 D Scott, Montgomery
```

```
Programmer: Bill McQuain
StarFleet Payroll
```

ID	Gross Pay	FIT	SSI	Ins	Net Pay
3175	7597.43	2227.15	518.90	100.00	4751.37
5328	3000.00	710.00	204.90	180.00	1905.10
3236	3897.89	1006.30	266.23	70.00	2555.36
2334	2089.10	454.95	142.69	180.00	1311.47
5315	9336.00	2800.88	637.65	150.00	5747.47
7641	5409.12	1505.01	369.44	180.00	3354.67
7077	1001.00	150.28	68.37	70.00	712.35
4098	8594.98	2556.34	587.04	140.00	5311.60
3424	2999.99	710.00	204.90	100.00	1985.09
4297	1000.00	150.00	68.30	100.00	681.70
1716	2011.50	433.22	137.39	180.00	1260.89
5956	5245.42	1450.99	358.26	250.00	3186.17
Avg:	4348.54	1179.59	297.00	141.67	2730.27

```
////////////////////////////////////  
// Identification  
//  
// Title:           Simple Payroll Program  
// Programmer:      Bill McQuain  
// ID Number:       999-99-9999  
// Compiler:        Visual C++ version 6.0  
// Platform:        Pentium II 400 / Windows NT  
// Last Modified:   January 2, 1999  
//  
////////////////////////////////////  
// Purpose of the program:  
//  
// This program reads information about an arbitrary number of  
// employees from an input file named "workers.dat":  
//  
//   - ID number  
//   - age  
//   - gross monthly salary  
//   - insurance plan type  
//  
// and computes the correct deductions for:  
//  
//   - federal income tax  
//   - social security tax  
//   - insurance fee  
//   - net monthly salary.  
//  
// It then prints out a labeled table of results, showing for  
// each employee the ID number, gross salary, insurance fee,  
// income and social security tax deductions and net salary.  
// In addition, the averages of each category are computed and  
// printed.  Output is to a file named "payola.dat".  
//
```

```
// The is the #include section. These statements tell the compiler
// to read and use variables and functions declared in the
// specified files.
#include <fstream.h>
#include <iomanip.h>

// Every C++ program must have a function named main. This is the
// beginning of the definition of the main function for this
// simple program. In this case the whole program consists of just
// the main function --- usually programs involve more than one
// function.
//
int main() {
// In this section, named constants are declared and given
// their values. We could just use the numbers themselves in the
// code that follows, but the names make the code more readable;
// the name SSRate carries meaning where the number 0.0683 doesn't.
//
const double HiTax = 0.33;           // income tax rates
const double MidTax = 0.28;
const double LoTax = 0.15;
const double SSRate = 0.0683;       // ssi tax rate

const double HiBasic = 150.00;      // insurance fees
const double MidBasic = 100.00;
const double LoBasic = 70.00;
const double HiDeluxe = 250.00;
const double MidDeluxe = 180.00;
const double LoDeluxe = 140.00;

const double HiIncome = 3000.00;    // income levels
const double MidIncome = 1000.00;

const char Basic = 'B';             // insurance plan type codes
const char Deluxe = 'D';
```

```
// In this section, the variables used in main() are declared.
// Each variable has a type (integer, double, etc) but no particular
// value at this point. The variable names like the constant names
// used above are supposed to be meaningful, and each declared
// variable is also given a short comment explaining what it will
// be used for.
//
ifstream inPay;           // input file stream
ofstream outPay;         // output file stream

int    IdNum,             // employee ID number,
       Age,               //          age.
       NumEmployees;     // number of employees.
double GrossPay,         // employee gross pay.
       NetPay,           //          net pay,
       SSI,              //          SS tax,
       FIT,              //          income tax,
       InsFee,           //          insurance fee..
       TotalGross,      // total of all gross pay,
       TotalNet,        //          net pay,
       TotalIns,        //          insurance fees,
       TotalSSI,        //          SSI tax,
       TotalFIT;        //          income tax.
char   InsPlan;          // employee insurance plan
```

```
// This is the initialization section of main(). We must ensure
// every variable is given a value before it is used in a
// calculation or printed. Some variables get their values by being
// read from the input file, so they don't need to be initialized
// here.
NumEmployees = 0; // Initialize counters and running totals
TotalGross = 0.0; // to zero.
TotalNet = 0.0;
TotalIns = 0.0;
TotalSSI = 0.0;
TotalFIT = 0.0;

// The following four statements prepare the input and output files
// for use. Don't worry too much about what's going on here just
// yet, we'll cover the details shortly.
//
inPay.open("workers.dat"); // open input and output files
outPay.open("payola.dat");
outPay.setf(ios::fixed, ios::floatfield);
outPay.setf(ios::showpoint);

// The following statements print the header info to output file.
// It's rather cryptic at this point, but you'll see output is
// really very simple in C++.

outPay << "Programmer: Bill McQuain" << endl;
outPay << "StarFleet Payroll" << endl << endl;
outPay << " ID Gross Pay FIT SSI Ins"
<< " Net Pay";
outPay << endl;
outPay << "====="
<< "=====";
outPay << endl;
```

```
// This statement tries to read first line of data from input file.
// If something goes wrong, the variable inPay will be false (small
// lie) and that will prevent us from going into the loop that
// follows and generating nonsense.

inPay >> IdNum >> Age >> GrossPay >> InsPlan;

// What comes next is a while loop. The body of the loop gets
// executed over and over again until the expression that follows
// the while (inPay in this case) becomes false. Therefore, we'd
// better be sure that inPay will eventually become false,
// otherwise the program will continue to execute the body of this
// loop forever.

while (inPay) {

    // The first part of the loop body (down to the comment with
    // all the hyphens) processes the data that was just read in.

    NumEmployees++;           // Count employees. This statement
                              // adds 1 to the value of the
                              // variable NumEmployees.

    TotalGross += GrossPay;   // Update total gross pay. This
                              // statement adds the value of
                              // the variable GrossPay to the
                              // variable TotalGross
```

```
// The switch statement tries to match the value of the
// selection variable (InsPlan this time) with the given cases.
// When a match is found, the statements that accompany that
// case are executed. If no match is found, the default case
// is carried out.

switch (InsPlan) { // Calculate insurance fees:
case Basic:{ if (Age <= 35) // for Basic plan
             InsFee = LoBasic; // This statement copies the
                               // value of the constant
                               // LoBasic to the variable
                               // InsFee -- assignment.
             else if (Age <= 65)
               InsFee = MidBasic;
             else
               InsFee = HiBasic;
             break;
           }
case Deluxe:{ if (Age <= 35) // for Deluxe plan
              InsFee = LoDeluxe;
              else if (Age <= 65)
                InsFee = MidDeluxe;
              else
                InsFee = HiDeluxe;
              break;
            }
default :{ cout << "Employee " << setw(4) << IdNum;
           cout << " has invalid insurance plan." << endl;
           InsFee = 0.0;
         }
}
```

```
TotalIns += InsFee;           // Update total insurance fees.

if (GrossPay <= MidIncome) {   // Determine FIT amount.
    FIT = LoTax * GrossPay;     // low income
}
else if (GrossPay <= HiIncome) {
    FIT = LoTax * MidIncome     // middle income
        + MidTax * (GrossPay - MidIncome);
}
else {
    FIT = LoTax * MidIncome     // high income
        + MidTax * (HiIncome - MidIncome)
        + HiTax * (GrossPay - HiIncome);
}
TotalFIT += FIT;              // Update total income taxes.

SSI = SSRate * GrossPay;      // Calculate SSI tax.
TotalSSI += SSI;              // Update total SS taxes.

NetPay = GrossPay - InsFee -
        FIT - SSI;           // Calculate net pay.
TotalNet += NetPay;          // Update total net pay.

// This section of the loop body prints the results calculated
// above into the output file.

outPay << setw( 6) << IdNum;
outPay << setw(12) << setprecision(2) << GrossPay;
outPay << setw(10) << setprecision(2) << FIT;
outPay << setw(10) << setprecision(2) << SSI;
outPay << setw(10) << setprecision(2) << InsFee;
outPay << setw(12) << setprecision(2) << NetPay;
outPay << endl;

// ----- End of Processing Section
```

```
// This statement skips over the employee names to the
// beginning of the next line of input.
inPay.ignore(200, '\n');

// This statement tries to read the next line of input. This
// is the last statement in the loop body, so the next thing
// that will happen is that the loop control expression (inPay
// in this case) is tested.
inPay >> IdNum >> Age >> GrossPay >> InsPlan;
} // End of while loop.

// Once we've exited the loop, we're done reading and processing
// data for new employees. It's time to sum things up. The
// following statements print out the averages in a nice form.
// First print a line to mark the end of the table body:

outPay << "====="
      << "=====";
outPay << endl;

// Now, calculate and print averages, if appropriate. We've got to
// be careful not to calculate averages if there weren't any
// employees, so this uses an if statement to be sure that's not
// the case before any dividing is done.

if (NumEmployees > 0) {
    outPay << " Avg:";
    outPay << setprecision(2);
    outPay << setw(12) << TotalGross/NumEmployees;
    outPay << setw(10) << TotalFIT/NumEmployees;
    outPay << setw(10) << TotalSSI/NumEmployees;
    outPay << setw(10) << TotalIns/NumEmployees;
    outPay << setw(12) << TotalNet/NumEmployees;
    outPay << endl;
}
```

```
// These two statements just close the input and output files; this
// tells the operating system that we're done with them and
// (hopefully) that the files are properly saved to disk.

    inPay.close();
    outPay.close();

// The return statement sends a value back to whoever called this
// function.  If you're using Visual C++, you may see this value
// displayed in the window at the bottom of the screen when you run
// the program.

    return NumEmployees;
}
```

The slides that follow show several variations and extensions of the simple payroll program. These variations illustrate the use of many of the language features covered in sections 6 through 12 of the course notes. In short:

FuncPay.cpp	modularization of Payroll.cpp using user-defined functions
ArrayPay.cpp	improved data handling using parallel arrays to store employee data
SortPay.cpp	output results sorted by net pay
StructPay.cpp	improved data organization using a single array of struct variables to store all employee data
NamesPayA.cpp	input and output of character strings; use of multiple input files; use of char array for strings and of some of the standard library string functions
NamesPayS.cpp	modification of NamesPayA.cpp to use standard library string objects

During the term, the source for these examples will be available on the course website:

<http://courses.cs.vt.edu/~cs1044/>

```
////////////////////////////////////  
// Title:           Simple Payroll with Functions  
// Programmer:      Bill McQuain  
// ID Number:       999-99-9999  
// Compiler:        Microsoft Visual C++ ver 6.0  
// Platform:        Pentium II 400, Windows NT  
// Last modified:   January 2, 1999  
//  
// Purpose:  
//  
//   The same as the simple payroll program, Pay99.cpp.  
//  
// Implementation Issues:  
//  
//   This is an alteration of Pay98.cpp to incorporate user-  
//   defined functions and an improved modular design.  
//  
//   While there are no changes to the calculation logic,  
//   the organization of the code is substantially different.  
//  
//   Extensive comments describe the changes made to the  
//   original.  
//  
#include <fstream.h>  
#include <iomanip.h>
```

```
// Beginning of main function:
int main() {

// Function prototypes.  It's not necessary to include names for
// the parameters here, but I recommend it because it helps keep
// things straight.

double FedTax(double Gross);
double Insurance(char Plan, int Age);
void PrintHeader(ofstream& outPay);
void PrintLine(ofstream& outPay, int IdNum, double Gross,
               double Fee, double FIT, double SSI, double Net);
void PrintAvg(ofstream& outPay, double TotalGross, double TotalIns,
              double TotalFIT, double TotalSSI, double TotalNet,
              int NumEmployees);

// Named constants --- the use of named constants is required for
// this program.  Other named are used in the functions that find
// the income tax and insurance amounts.
//
const double SSRate = 0.0683;    // SSI tax rate

// Variables:
ifstream inPay;           // input file stream
ofstream outPay;         // output file stream

int IdNum,                // employee ID number
    Age,                  // employee age
    NumEmployees;        // number of employees
double GrossPay,         // employee gross pay
    NetPay,              // employee net pay
    SSI,                 // employee SS tax
    FIT,                 // employee income tax
    InsFee,              // employee insurance fee
// declarations continued on next slide
```

```
TotalGross,    // total of all gross pay
TotalNet,      // total of all net pay
TotalIns,      // total of all insurance fees
TotalSSI,      // total of all SS tax
TotalFIT;      // total of all income tax
char   InsPlan; // employee insurance plan

// Initializations:  NumEmployees =  0;
// Initialize counters and running totals
TotalGross  = 0.0;    // to zero.
TotalNet    = 0.0;
TotalIns    = 0.0;
TotalSSI    = 0.0;
TotalFIT    = 0.0;

inPay.open("workers.dat");    // open input and output files
outPay.open("payola.dat");

                                // Set up for floating point output:
outPay.setf(ios::fixed, ios::floatfield);
outPay.setf(ios::showpoint);
// Print header info to output file:
PrintHeader(outPay);
// Read first line of data from input file:
inPay >> IdNum >> Age >> GrossPay >> InsPlan;
```

```
// Process and read next line until there's no more data:
while (inPay) {

    NumEmployees++;           // Count employees.
    TotalGross += GrossPay;   // Update total gross pay.

    InsFee = Insurance(InsPlan, Age); // Calculate insurance fee
    TotalIns += InsFee;       // Update total insurance
                                //          fees.

    FIT = FedTax(GrossPay);   // Calculate income tax amt.
    TotalFIT += FIT;          // Update total income
                                //          taxes.

    SSI = GrossPay * SSRate;  // Calculate SS tax.
    TotalSSI += SSI;         // Update total SS taxes.

    NetPay = GrossPay - InsFee -
                FIT - SSI;    // Calculate net pay.
    TotalNet += NetPay;      // Update total net pay.

    // Write results to output file:
    PrintLine(outPay, IdNum, GrossPay, InsFee, FIT, SSI, NetPay);

    // Read next line of input:
    inPay.ignore(200, '\n');   // Skip to next line.
    inPay >> IdNum >> Age >> GrossPay >> InsPlan;
}                               // End of while loop.
```

```
// Print out averages (if appropriate):
    PrintAvg(outPay, TotalGross, TotalIns, TotalFIT, TotalSSI,
            TotalNet, NumEmployees);

// Close files.
    inPay.close();
    outPay.close();

    return NumEmployees;
} // end of main()
```

```
////////////////////////////////////  
// Function to calculate the proper insurance fee for an employee.  
// Parameters:  
//     InsPlan    character 'B' or 'D', indicating plan selected  
//     Age        employee's age  
//  
// The function doesn't need to modify the value of either of these  
// parameters, so they are passed in by value (no ampersand).  
//  
// Return value:  
//     InsFee     insurance fee charged to employee  
//  
// Pre: Plan and Age have been properly initialized  
// Post: corresponding insurance fee has been returned  
//  
double Insurance(char Plan, int Age) {  
    const double HiBasic    = 150.00;    // constants for insurance fees  
    const double MidBasic   = 100.00;  
    const double LoBasic    =  70.00;  
    const double HiDeluxe   = 250.00;  
    const double MidDeluxe  = 180.00;  
    const double LoDeluxe   = 140.00;  
    const char   Basic      = 'B';       // constants for plan types  
    const char   Deluxe     = 'D';  
    double Fee = 0.0;                   // insurance fee charged
```

```
switch (Plan) { // Calculate insurance fee
case Basic:{ if (Age <= 35) // for Basic Plan
                Fee = LoBasic;
            else if (Age <= 65)
                Fee = MidBasic;
            else
                Fee = HiBasic;
            break;
        }
case Deluxe:{ if (Age <= 35) // for Deluxe Plan
                Fee = LoDeluxe;
            else if (Age <= 65)
                Fee = MidDeluxe;
            else
                Fee = HiDeluxe;
            break;
        }
}
return Fee;
}
```

```
////////////////////////////////////  
// Function to calculate the proper income tax for an employee.  
// Parameter:  
//     GrossPay     employee's gross pay amount  
//  
// Return value:  
//     FIT          income tax withheld for employee  
//  
// Pre:  Gross has been properly initialized  
// Post: corresponding income tax amount has been returned  
//  
double FedTax(double Gross) {  
    const double HiTax  = 0.33;           // tax rates  
    const double MidTax = 0.28;  
    const double LoTax  = 0.15;  
  
    const double HiIncome = 3000.00;    // income levels  
    const double MidIncome = 1000.00;  
  
    double FIT = 0.0;                   // income tax withheld  
  
    if (Gross <= MidIncome) {           // Determine FIT amount.  
        FIT = LoTax * Gross;           // low income  
    }  
    else if (Gross <= HiIncome) {  
        FIT = LoTax * MidIncome        // middle income  
            + MidTax * (Gross - MidIncome);  
    }  
    else {  
        FIT = LoTax * MidIncome        // high income  
            + MidTax * (HiIncome - MidIncome)  
            + HiTax * (Gross - HiIncome);  
    }  
    return FIT;  
}
```

```
////////////////////////////////////  
// Function to print header for output file.  
// Parameter:  
//   outPay      input file stream variable  
//  
// The function does need to modify this stream (by inserting to  
// it), so the parameter must be passed by reference (with an  
// ampersand).  
//  
// The function doesn't need to return a value, so it's void.  
//  
// Pre:  output file has been opened  
// Post: file header has been written  
//  
void PrintHeader(ofstream& outPay) {  
    outPay << "Programmer:  Bill McQuain" << endl;  
    outPay << "StarFleet Payroll" << endl << endl;  
    outPay << "   ID      Gross Pay      FIT          SSI          Ins"  
           << "          Net Pay";  
    outPay << endl;  
    outPay << "===== "  
           << "===== "  
    outPay << endl;  
}
```

```
////////////////////////////////////  
// Function to print a line of employee data to output file.  
// Parameter:  
//     outPay      input file stream variable  
//     IdNum       id number of employee  
//     GrossPay    gross pay for employee  
//     InsFee      insurance fee for employee  
//     FIT         income tax for employee  
//     SSI         social security tax for employee  
//     NetPay      net pay for employee  
//  
// The function does need to modify this stream (by inserting to  
// it), so the parameter must be passed by reference (with an  
// ampersand).  
//  
// Pre:  output file has been opened; other parameters have been  
//       properly initialized  
// Post: formatted line of output has been written  
//  
void PrintLine(ofstream& outPay, int IdNum, double Gross,  
              double Fee, double FIT, double SSI, double Net) {  
    outPay << setw( 6) << IdNum;  
    outPay << setw(12) << setprecision(2) << Gross;  
    outPay << setw(10) << setprecision(2) << FIT;  
    outPay << setw(10) << setprecision(2) << SSI;  
    outPay << setw(10) << setprecision(2) << Fee;  
    outPay << setw(12) << setprecision(2) << Net;  
    outPay << endl;  
}
```

```

////////////////////////////////////
// Function to print final averages to input file.
// Parameter:
//   outPay          input file stream variable
//   TotalGross      total gross pay (for all employees)
//   TotalIns        total insurance fees
//   TotalFIT        total income tax
//   TotalSSI        total social security tax
//   TotalNet        total net pay
//   NumEmployees    total number of employees
//
// The function does need to modify this stream (by inserting to
// it), so the parameter must be passed by reference (with an
// ampersand).
//
// Pre:  output file has been opened; other parameters have been
//       properly initialized
// Post: formatted averages have been printed, if number of
//       employees is positive
//
void PrintAvg(ofstream& outPay, double TotalGross, double TotalIns,
             double TotalFIT, double TotalSSI, double TotalNet,
             int NumEmployees) {
    outPay << "====="
           << "====="
           << endl;
    if (NumEmployees > 0) {
        outPay << "  Avg:" << setprecision(2);
        outPay << setw(12) << TotalGross/NumEmployees;
        outPay << setw(10) << TotalFIT/NumEmployees;
        outPay << setw(10) << TotalSSI/NumEmployees;
        outPay << setw(10) << TotalIns/NumEmployees;
        outPay << setw(12) << TotalNet/NumEmployees << endl;
    }
}

```

```
////////////////////////////////////  
// Title:           Payroll Program with Arrays  
// Programmer:      Bill McQuain  
// ID Number:       999-99-9999  
// Compiler:        Microsoft Visual C++ ver 6.0  
// Platform:        Pentium II 400, Windows NT  
// Last modified:   January 2, 1999  
//  
// Purpose:  
//  
//     Same as the original version, Pay99.cpp.  
//  
// Implementation Issues:  
//  
//     The principal alteration is that this program uses a  
//     collection of parallel arrays to store all the data.  
//     An assumption is made as to the maximum number of  
//     employees for whom data will be processed; for ease  
//     of modification, that value is set as a file-scoped  
//     constant.  
//  
//     By "parallel" I mean that array elements with the  
//     same index will hold information about the same  
//     employee.  
//  
//     Other changes (from FuncPay99.cpp):  
//  
//     - The overall structure of main() is now divided  
//       into logical sections:  
//         - declarations  
//         - function call to read data  
//         - function call to calculate taxes, insurance,  
//           net pay  
//         - function call to print the table, including  
//           header and averages  
//
```

```
// - The input file is needed only by the function
//   ReadData() and the output file is needed only by
//   the function PrintTable() and the functions
//   PrintHeader() and CalcAvg(), which are called by
//   PrintTable(). Therefore, the input and output file
//   stream variables are made local to ReadData() and
//   PrintTable() respectively.
//
#include <fstream.h>
#include <iomanip.h>

const int MaxEmp = 20;      // maximum number of employees

// Function prototypes. It's not necessary to include names for
// the parameters here, but I recommend it because it helps keep
// things straight.

double FedTax(double EmpGrossPay);
double Insurance(char EmpInsPlan, int EmpAge);
void PrintHeader(ofstream& outPay);
void ReadData(int IdNum[], double GrossPay[],
              int Age[], char InsPlan[], int& NumEmp);
void CalcData(const double GrossPay[], const int Age[],
              const char InsPlan[], double InsFee[], double FIT[],
              double SSI[], double NetPay[], int NumEmp);
void PrintTable(const int IdNum[], const double GrossPay[],
               const double InsFee[], const double FIT[],
               const double SSI[],
               const double NetPay[],int NumEmp);
void CalcAvg(ofstream& outPay, const double GrossPay[],
             const double InsFee[],
             const double FIT[], const double SSI[],
             const double NetPay[], int NumEmp);
```

```
////////////////////////////////////  
// Beginning of main function:  
//  
int main() {  
  
// Local variables for main():  
  
    int    IdNum[MaxEmp],        // employee ID number  
          Age[MaxEmp],          // employee age  
          NumEmp;               // number of employees  
    double GrossPay[MaxEmp],    // employee gross pay  
          NetPay[MaxEmp],       // employee net pay  
          SSI[MaxEmp],          // employee SS tax  
          FIT[MaxEmp],          // employee income tax  
          InsFee[MaxEmp];       // employee insurance fee  
    char   InsPlan[MaxEmp];     // employee insurance plan  
  
// Read employee data from input file:  
  
    ReadData(IdNum, GrossPay, Age, InsPlan, NumEmp);  
  
// Calculate employee withholding data and net pay:  
  
    CalcData(GrossPay, Age, InsPlan, InsFee, FIT, SSI,  
            NetPay, NumEmp);  
  
// Print the table of employee information:  
  
    PrintTable(IdNum, GrossPay, InsFee, FIT, SSI, NetPay,  
              NumEmp);  
  
    return NumEmp;  
}                                     // end of main()
```

```
////////////////////////////////////
// The function ReadData reads employee data from the input
// file and stores it in the array parameters. ReadData will
// read until the end of the input file or until the arrays
// are filled (determined by the global constant MaxEmp).
//
// Output parameters (passed by reference):
//
//   IdNum[]      list of employee ID numbers
//   GrossPay[]   list of gross pay amounts
//   Age[]        list of employee ages
//   InsPlan[]    list of insurance plan codes
//   NumEmp       number of employees for whom data was
//                stored
//
// Remember:  An array parameter is passed by reference
//            by default, so no ampersands (&) are needed
//            for them.
//
// Also note: We don't need to specify the dimension of an
//            array parameter in the function definition
//            (or in the prototype).  But you do need to
//            indicate that it's an array; that's the reason
//            for the []s.
//
// ReadData must be able to handle the situation where
// there are more lines of input data than will fit into
// the arrays.  This is done by using two mechanisms.  First,
// the loop control for the while includes both a check for a
// read failure and a check to be sure that we're not about
// to try to store values past the end of the arrays.  Second,
// we read the input values into local variables first, then
// transfer them to the arrays only if the array index is
// valid (MaxEmp - 1 or less).
```

```
// One point that may be confusing. The local variable Index
// is used to keep track of which array locations are to be
// stored into next. When we exit the while loop, Index will
// point to the first unfilled location in the arrays.
// However, Index will equal the number of employees whose
// records were stored into the arrays. Remember that in C++
// we index arrays starting at 0 instead of 1.
//
// Pre: none
// Post: up to MaxEmp employee data lines have been read from
//       the input file; data stored in IdNum[], GrossPay[],
//       Age[] and InsPlan[]; number of employee data lines
//       read stored in NumEmp.
//
void ReadData(int IdNum[], double GrossPay[], int Age[],
              char InsPlan[], int& NumEmp) {

    int    Index = 0; // next array location to fill

    int    empnum,    // temp storage for employee id number
           empage;   // employee age,
    double gross;    // gross pay, and
    char   plan;     // insurance plan code
    ifstream inPay;  // input file stream

    inPay.open("workers.dat"); // open input file

    // Read first line of data from input file:

    inPay >> empnum >> empage >> gross >> plan;
```

```
// Process and read next line until there's no more data or
// we've filled up the arrays:

while (inPay && Index < MaxEmp) {

    inPay.ignore(200, '\n');    // Skip to next line.

    IdNum[Index]    = empnum;    // Store the last input line
    Age[Index]      = empage;    //      in the relevant arrays
    GrossPay[Index] = gross;
    InsPlan[Index]  = plan;

    inPay >> empnum >> empage >> gross >> plan;

    Index++;          // Update index for next store
}

NumEmp = Index;    // Remember: we never stored anything
                // after the last increment of Index

inPay.close();    // Close the input file.
}
```

```
////////////////////////////////////  
// CalcData is used to calculate the net pay amounts for all  
// employees.  
//  
// Input Parameters (passed by value):  
//  
//   GrossPay[]    list of gross pay amounts  
//   Age[]         list of employee ages  
//   InsPlan[]     list of insurance plan codes  
//   NumEmp        number of employees to be processed  
//  
// Note:  to pass array parameters by value we specify their  
//        type using "const" --- both in the definition and  
//        in the prototype.  This is really "pass by constant  
//        reference" as we'll discuss in class.  For  
//        practical purposes, the effect is the same as pass  
//        by value.  
//  
// Output Parameters (passed by reference):  
//  
//   InsFee[]      list of insurance fees  
//   FIT[]         list of federal income taxes  
//   SSI[]         list of social security taxes  
//   NetPay[]      list of net pay amounts  
//  
// Pre:  GrossPay[], Age[], InsPlan[], InsFee[] initialized;  
//       NumEmp equals number of employees  
// Post: FIT[], SSI[] and NetPay[] properly calculated  
//  
void CalcData(const double GrossPay[], const int Age[],  
              const char InsPlan[], double InsFee[], double FIT[],  
              double SSI[], double NetPay[], int NumEmp){  
  
    const double SSRate = 0.0683;           // SSI tax rate
```

```
////////////////////////////////////  
// Calculate the insurance fee, income tax, social security  
// tax and net pay for each employee, storing the results in  
// the relevant arrays:  
//  
for (int count = 0; count < NumEmp; count++) {  
  
    InsFee[count] = Insurance(InsPlan[count], Age[count]);  
    FIT[count]    = FedTax(GrossPay[count]);  
    SSI[count]    = SSRate * GrossPay[count];  
    NetPay[count] = GrossPay[count] - FIT[count] - SSI[count] -  
                    InsFee[count];  
}  
}
```

```
////////////////////////////////////  
// Function to calculate the proper insurance fee for an employee.  
// Parameters:  
//     InsPlan      character 'B' or 'D', indicating plan selected  
//     Age          employee's age  
//  
// The function doesn't need to modify the value of either of these  
// parameters, so they are passed in by value (no ampersand).  
//  
// Return value:  
//     InsFee       insurance fee charged to employee  
//  
// Pre:  Plan and Age have been properly initialized  
// Post: corresponding insurance fee has been returned  
//  
double Insurance(char Plan, int Age) {  
  
    const double HiBasic   = 150.00;    // constants for insurance fees  
    const double MidBasic  = 100.00;  
    const double LoBasic   =  70.00;  
    const double HiDeluxe  = 250.00;  
    const double MidDeluxe = 180.00;  
    const double LoDeluxe  = 140.00;  
  
    const char  Basic      = 'B';        // constants for plan types  
    const char  Deluxe     = 'D';  
  
    double Fee = 0.0;                    // insurance fee charged
```

```
switch (Plan) { // Calculate insurance fee
  case Basic:{ if (Age <= 35) // for Basic Plan
               Fee = LoBasic;
               else if (Age <= 65)
               Fee = MidBasic;
               else
               Fee = HiBasic;
               break;
            }
  case Deluxe:{ if (Age <= 35) // for Deluxe Plan
                Fee = LoDeluxe;
                else if (Age <= 65)
                Fee = MidDeluxe;
                else
                Fee = HiDeluxe;
                break;
            }
}

return Fee;
}
```

```
////////////////////////////////////  
// Function to calculate the proper income tax for an employee.  
// Parameter:  
//     GrossPay    employee's gross pay amount  
// Return value:  
//     FIT         income tax withheld for employee  
// Pre:  Gross has been properly initialized  
// Post: corresponding income tax amount has been returned  
//  
double FedTax(double Gross) {  
  
    const double HiTax  = 0.33;           // tax rates  
    const double MidTax = 0.28;  
    const double LoTax  = 0.15;  
  
    const double HiIncome = 3000.00;    // income levels  
    const double MidIncome = 1000.00;  
  
    double FIT = 0.0;                   // income tax withheld  
  
    if (Gross <= MidIncome) {           // Determine FIT amount.  
        FIT = LoTax * Gross;            // low income  
    }  
    else if (Gross <= HiIncome) {  
        FIT = LoTax * MidIncome         // middle income  
            + MidTax * (Gross - MidIncome);  
    }  
    else {  
        FIT = LoTax * MidIncome         // high income  
            + MidTax * (HiIncome - MidIncome)  
            + HiTax * (Gross - HiIncome);  
    }  
  
    return FIT;  
}
```

```
////////////////////////////////////  
// Function to print header for output file.  
// Parameter:  
//   outPay      input file stream variable  
//  
// The function does need to modify this stream (by inserting to  
// it), so the parameter must be passed by reference (with an  
// ampersand).  
//  
// The function doesn't need to return a value, so it's void.  
//  
// Pre:  output file has been opened  
// Post: file header has been written  
//  
void PrintHeader(ofstream& outPay) {  
  
    outPay << "Programmer:  Bill McQuain" << endl;  
    outPay << "StarFleet Payroll" << endl << endl;  
    outPay << "   ID      Gross Pay      FIT          SSI          Ins"  
           << "          Net Pay";  
    outPay << endl;  
    outPay << "===== "  
           << "===== "  
    outPay << endl;  
  
}
```

```
////////////////////////////////////  
// PrintTable is used to print the table of employee data to output  
// file.  
//  
// Input Parameters (passed by value):  
//  
//     IdNum         id numbers of employees  
//     GrossPay      gross pay for employees  
//     InsFee        insurance fees for employees  
//     FIT           income taxes for employees  
//     SSI           social security taxes for employees  
//     NetPay        net pay for employees  
//     NumEmp        number of employees to print data for  
//  
// Pre:  arrays hold proper data  
// Post: table of payroll data has been printed to output file  
//  
void PrintTable(const int IdNum[], const double GrossPay[],  
                const double InsFee[], const double FIT[],  
                const double SSI[], const double NetPay[],  
                int NumEmp) {  
  
    ofstream outPay;                // output file stream  
  
    outPay.open("payola.dat"); // open the output file  
                                // Set up for floating point output:  
    outPay.setf(ios::fixed, ios::floatfield);  
    outPay.setf(ios::showpoint);  
}
```

```
// Print the header for the table:
//
PrintHeader(outPay);

// Print the table, line by line:
//
for (int count = 0; count < NumEmp; count++) {

    outPay << setw( 6) << IdNum[count];
    outPay << setw(12) << setprecision(2) << GrossPay[count];
    outPay << setw(10) << setprecision(2) << FIT[count];
    outPay << setw(10) << setprecision(2) << SSI[count];
    outPay << setw(10) << setprecision(2) << InsFee[count];
    outPay << setw(12) << setprecision(2) << NetPay[count];
    outPay << endl;
}

// Calculate and print averages:
//
CalcAvg(outPay, GrossPay, InsFee, FIT, SSI, NetPay, NumEmp);
}
```

```
////////////////////////////////////  
// CalcAvg is used to print final averages to input file.  
//  
// Output Parameter (passed by reference):  
//  
//     outPay           output file stream variable  
//  
// Input Parameters (passed by value):  
//  
//     TotalGross       total gross pay (for all employees)  
//     TotalIns         total insurance fees  
//     TotalFIT         total income tax  
//     TotalSSI        total social security tax  
//     TotalNet        total net pay  
//     NumEmployees    total number of employees  
//  
// Pre:  output file is open; arrays hold proper data  
// Post: if number of employees is positive, averages  
//       have been printed; otherwise zeros are printed  
//  
void CalcAvg(ofstream& outPay, const double GrossPay[],  
             const double InsFee[],  
             const double FIT[], const double SSI[],  
             const double NetPay[], int NumEmp) {  
  
    double TotalGross = 0.0,    // total of all gross pay  
           TotalNet   = 0.0,    // total of all net pay  
           TotalIns   = 0.0,    // total of all insurance fees  
           TotalSSI   = 0.0,    // total of all SS tax  
           TotalFIT   = 0.0;    // total of all income tax  
  
    // Print out footer for table:  
  
    outPay << "=====  
           << "=====" << endl;
```

```
// If NumEmp > 0 then calculate totals and print out averages;
// otherwise print zeros for the averages.
//
if (NumEmp) {

    for (int count = 0; count < NumEmp; count++) {
        TotalGross += GrossPay[count];
        TotalIns    += InsFee[count];
        TotalFIT    += FIT[count];
        TotalSSI    += SSI[count];
        TotalNet    += NetPay[count];
    }
    outPay << " Avg:" << setprecision(2);
    outPay << setw(12) << TotalGross/NumEmp;
    outPay << setw(10) << TotalFIT/NumEmp;
    outPay << setw(10) << TotalSSI/NumEmp;
    outPay << setw(10) << TotalIns/NumEmp;
    outPay << setw(12) << TotalNet/NumEmp;
    outPay << endl;
}
else {
    outPay << " Avg:" << setprecision(2);
    outPay << setw(12) << 0.0;
    outPay << setw(10) << 0.0;
    outPay << setw(10) << 0.0;
    outPay << setw(10) << 0.0;
    outPay << setw(12) << 0.0;
    outPay << endl;
}
}
```

SortPay.cpp incorporates an additional function to ArrayPay.cpp, producing an output file that is sorted by net pay amounts. Since the only alterations are the inclusion of a prototype, a function definition, and a call to that function from main( ), only the new function definition is provided here.

Sample input and output files:

```
3175 45 7597.43 B McCoy, Leonard
5328 47 3000.00 D Checkov, Pavel
3236 35 3897.89 B Sulu, Hikaru
2334 49 2089.10 D Riley, Kevin
5315 73 9336.00 B Kirk, James
7641 58 5409.12 D Uhura
7077 23 1001.00 B Rand, Janice
4098 32 8594.98 D Spock
3424 39 2999.99 B Solo, Han
4297 52 1000.00 B Chewbacca
1716 53 2011.50 D Skywalker, Luke
5956 67 5245.42 D Scott, Montgomery
```

Bill McQuain  
Macro\$oft Corporation Payroll

ID	Gross Pay	FIT	SSI	Ins	Net Pay
4297	1000.00	150.00	68.30	100.00	681.70
7077	1001.00	150.28	68.37	70.00	712.35
1716	2011.50	433.22	137.39	180.00	1260.89
2334	2089.10	454.95	142.69	180.00	1311.47
5328	3000.00	710.00	204.90	180.00	1905.10
3424	2999.99	710.00	204.90	100.00	1985.09
3236	3897.89	1006.30	266.23	70.00	2555.36
5956	5245.42	1450.99	358.26	250.00	3186.17
7641	5409.12	1505.01	369.44	180.00	3354.67
3175	7597.43	2227.15	518.90	100.00	4751.37
4098	8594.98	2556.34	587.04	140.00	5311.60
5315	9336.00	2800.88	637.65	150.00	5747.47
Avg:	4348.54	1179.59	297.00	141.67	2730.27

```
//////////////////////////////////////////////////////////////////
// SortData sorts the array of NetPay amounts into increasing
// order, rearranging the data in the other arrays to keep
// everything consistent. The selection sort algorithm is used.
//
// Input Parameters (passed by value):
//
//   IdNum      id numbers of employees
//   GrossPay   gross pay for employees
//   InsFee     insurance fees for employees
//   FIT        income taxes for employees
//   SSI        social security taxes for employees
//   NetPay     net pay for employees
//   Age        ages of employees
//   InsPlan    insurance plan codes for employees
//   NumEmp     number of employees
//
// Pre:  all parameters are properly initialized; NumEmp equals
//       number of employees being processed
// Post: NetPay[] is sorted in ascending order; all other arrays
//       are maintained in proper relative order
//
void SortData(int IdNum[], double GrossPay[], double InsFee[],
              double FIT[], double SSI[], double NetPay[],
              int Age[], char InsPlan[], int NumEmp) {

    int Begin,          // beginning index for current pass
        Check,         // index currently being checked
        SmallSoFar;    // index of largest entry found so far

    int   TmpInt;      // temporary storage used for swapping values
    double TmpFloat;
    char   TmpChar;
```

```
// The outer loop runs us down the list NumEmp - 1 times:
//
for (Begin = 0; Begin < NumEmp - 1; Begin++) {

    SmallSoFar = Begin;    // smallest so far is the first

    // The inner loop runs down the "tail" of the list,
    // determining where the smallest value is located.
    //
    // The value found will belong at the head of the "tail".
    //
    for (Check = Begin; Check < NumEmp; Check++) {
        if (NetPay[Check] < NetPay[SmallSoFar])
            SmallSoFar = Check;
    }

    // Swap the smallest net pay amount located by the inner
    // loop to the right index:
    //
    TmpFloat          = NetPay[SmallSoFar];
    NetPay[SmallSoFar] = NetPay[Begin];
    NetPay[Begin]     = TmpFloat;

    // ... and the corresponding (not the smallest) ID number:
    //
    TmpInt            = IdNum[SmallSoFar];
    IdNum[SmallSoFar] = IdNum[Begin];
    IdNum[Begin]     = TmpInt;

    // ... and the corresponding gross pay amount:
    //
    TmpFloat          = GrossPay[SmallSoFar];
    GrossPay[SmallSoFar] = GrossPay[Begin];
    GrossPay[Begin]   = TmpFloat;
}
```

```
// ... and the corresponding insurance fee:
//
TmpFloat          = InsFee[SmallSoFar];
InsFee[SmallSoFar] = InsFee[Begin];
InsFee[Begin]     = TmpFloat;

// ... and the corresponding income tax amount:
//
TmpFloat          = FIT[SmallSoFar];
FIT[SmallSoFar]   = FIT[Begin];
FIT[Begin]        = TmpFloat;

// ... and the corresponding social security amount:
//
TmpFloat          = SSI[SmallSoFar];
SSI[SmallSoFar]   = SSI[Begin];
SSI[Begin]        = TmpFloat;

// ... and the corresponding age:
//
TmpInt            = Age[SmallSoFar];
Age[SmallSoFar]   = Age[Begin];
Age[Begin]        = TmpInt;

// ... and finally, the corresponding insurance plan
//      code:
//
TmpChar           = InsPlan[SmallSoFar];
InsPlan[SmallSoFar] = InsPlan[Begin];
InsPlan[Begin]     = TmpChar;

}
}
```

```
////////////////////////////////////  
// Title:           Simple Payroll with an array of Structs  
// Programmer:      Bill McQuain  
// ID Number:       999-99-9999  
// Compiler:        Microsoft Visual C++ ver 6.0  
// Platform:        Pentium II 400, Windows NT  
// Last modified:   January 2, 1999  
//  
// Purpose:  
//  
//   Same as the original version, Pay99.cpp.  
//  
// Implementation Issues:  
//  
// The only modifications from ArrayPay99.cpp are related to  
// the use of an array of struct variables to hold the  
// employee records, replacing the bouquet of parallel arrays  
// used before. The primary points of interest are the vastly  
// simpler parameter lists that are needed now, and the  
// relatively trivial swap section of the sorting code.  
//  
#include <fstream.h>  
#include <iomanip.h>  
  
const int MaxEmp = 20; // maximum number of employees  
  
typedef struct {  
    int    IdNum;        // employee's ID number  
    int    Age;          // employee's age  
    char   InsPlan;      // employee's insurance plan code  
    double GrossPay;     // employee's gross pay  
    double InsFee;       // employee's insurance fee  
    double FIT;          // employee's federal income tax  
    double SSI;          // employee's social security tax  
    double NetPay;       // employee's net pay  
} EmpRec;
```

```
// Function prototypes:
void  ReadData(EmpRec Emp[], int& NumEmp);
void  CalcData(EmpRec Emp[], int NumEmp);
double FedTax(double EmpGrossPay);
double Insurance(char EmpInsPlan, int EmpAge);
void  SortData(EmpRec Emp[], int NumEmp);
void  PrintTable(const EmpRec Emp[],int NumEmp);
void  PrintHeader(ofstream& outPay);
void  CalcAvg(ofstream& outPay, const EmpRec Emp[], int NumEmp);

////////////////////////////////////
// Beginning of main function:
int main() {
// Local variables for main():
    EmpRec Emp[MaxEmp];          // array of employee records
    int  NumEmp;                 // number of employees

// Read employee data from input file:

    ReadData(Emp, NumEmp);

// Calculate employee withholding data and net pay:

    CalcData(Emp, NumEmp);

// Sort the data so net pay amounts are in increasing order:

    SortData(Emp, NumEmp);

// Print the table of employee information:

    PrintTable(Emp, NumEmp);

    return NumEmp;
}                                     // end of main()
```

```
////////////////////////////////////
// The function ReadData reads employee data from the input
// file and stores it in the array parameters. ReadData will
// read until the end of the input file or until the arrays
// are filled (determined by the global constant MaxEmp).
//
// Output parameters (passed by reference):
//
//     Emp[]      array of employee records
//     NumEmp     number of employees for whom data was stored
//
// Pre:  none
// Post: up to MaxEmp employee data lines have been read from
//       the input file; data stored in employee records in
//       Emp[]; number of employee data lines read stored in
//       NumEmp.
//
void ReadData(EmpRec Emp[], int& NumEmp) {

    int    Index = 0;    // next array location to fill

    int    empnum,       // temp storage for employee id number
           empage;      //      employee age,
    double gross;       //      gross pay, and
    char   plan;        //      insurance plan code

    ifstream inPay;           // input file stream

    inPay.open("workers.dat"); // open input file

    // Read first line of data from input file:

    inPay >> empnum >> empage >> gross >> plan;
```

```
// Process and read next line until there's no more data or
// we've filled up the arrays:

while (inPay && Index < MaxEmp) {

    inPay.ignore(200, '\n');        // Skip to next line.

    Emp[Index].IdNum    = empnum;   // Store the last input line
    Emp[Index].Age      = empage;   //      in an employee record
    Emp[Index].GrossPay = gross;
    Emp[Index].InsPlan  = plan;

    inPay >> empnum >> empage >> gross >> plan;

    Index++;                       // Update index for next store
}

NumEmp = Index;    // Remember: we never stored anything after
                  //      the last increment of Index

inPay.close();    // Close the input file.
}
```

```
////////////////////////////////////  
// CalcData is used to calculate the net pay amounts for all  
// employees.  
//  
// Input Parameters (passed by value):  
//  
//     NumEmp           number of employees to be processed  
//  
// Input/Output Parameters (passed by reference):  
//  
//     Emp[]           array of employee records  
//  
// Pre:  Emp[] stores NumEmp employee records, holding data  
//       for gross pay, age, id number, and insurance plan  
// Post: Emp[] updated for insurance fees, tax amounts, and  
//       net pay amounts  
//  
void CalcData(EmpRec Emp[], int NumEmp){  
  
    const double SSRate = 0.0683;           // SSI tax rate  
  
    //////////////////////////////////////  
    // Calculate the insurance fee, income tax, social security  
    // tax and net pay for each employee, storing the results in  
    // the relevant arrays:  
    //  
    for (int count = 0; count < NumEmp; count++) {  
  
        Emp[count].InsFee = Insurance(Emp[count].InsPlan,  
                                       Emp[count].Age);  
        Emp[count].FIT    = FedTax(Emp[count].GrossPay);  
        Emp[count].SSI    = SSRate * Emp[count].GrossPay;  
        Emp[count].NetPay = Emp[count].GrossPay - Emp[count].FIT -  
                           Emp[count].SSI - Emp[count].InsFee;  
    }  
}
```

```
////////////////////////////////////  
// Insurance is used to calculate the proper insurance fee for  
// an employee.  
//  
// Input Parameters (passed by value):  
//  
//   InsPlan    character 'B' or 'D', indicating plan selected  
//   Age        employee's age  
//  
// Return value:  
//  
//   InsFee     insurance fee charged to employee  
//  
float Insurance(char InsPlan, int Age) {  
  
// Body omitted --- identical to version in ArrayPay.cpp  
//  
  
////////////////////////////////////  
// FedTax is used to calculate the proper income tax for an  
// employee.  
//  
// Input Parameter (passed by value):  
//  
//   GrossPay   employee's gross pay amount  
//  
// Return value:  
//  
//   FIT        income tax withheld for employee  
//  
float FedTax(float GrossPay) {  
  
// Body omitted --- identical to version in ArrayPay.cpp  
//
```

```
////////////////////////////////////  
// SortData sorts the array of NetPay amounts into increasing  
// order, rearranging the data in the other arrays to keep  
// everything consistent. The selection sort algorithm is used.  
//  
// Input Parameters (passed by value):  
//  
//     NumEmp      number of employees  
//  
// Input/Output parameters (passed by reference):  
//  
//     Emp[]       array of employee records  
//  
// Pre:  all parameters are properly initialized; NumEmp equals  
//       number of employees being processed  
// Post: Emp[] is sorted in ascending order by net pay  
//  
void SortData(EmpRec Emp[], int NumEmp) {  
  
    int Begin,          // beginning index for current pass  
        Check,        // index currently being checked  
        SmallSoFar;   // index of largest entry found so far  
  
    EmpRec TmpEmp;     // temporary storage used for swapping
```

```
// The outer loop runs us down the list NumEmp - 1 times:
//
for (Begin = 0; Begin < NumEmp - 1; Begin++) {

    SmallSoFar = Begin;    // smallest so far is the first

    // The inner loop runs down the "tail" of the list,
    // determining where the smallest value is located.
    //
    // The value found will belong at the head of the "tail".
    //
    for (Check = Begin; Check < NumEmp; Check++) {
        if (Emp[Check].NetPay < Emp[SmallSoFar].NetPay)
            SmallSoFar = Check;
    }

    // Swap the employee record with smallest net pay amount,
    // located by the inner loop, to the right index:
    //
    TmpEmp          = Emp[SmallSoFar];
    Emp[SmallSoFar] = Emp[Begin];
    Emp[Begin]      = TmpEmp;
}
}
```

```
////////////////////////////////////  
// PrintTable is used to print the table of employee data to  
// output file.  
//  
// Input Parameters (passed by value):  
//  
//   Emp[]      array of employee records  
//   NumEmp     number of employees to print data for  
//  
// Pre:  Emp[] holds NumEmp employee records  
// Post: table of payroll data has been printed  
//  
void PrintTable(const EmpRec Emp[], int NumEmp) {  
  
    ofstream outPay;           // output file stream  
    outPay.open("payola.dat"); // open the output file  
                                // Set up for decimal output:  
    outPay.setf(ios::fixed, ios::floatfield);  
    outPay.setf(ios::showpoint);  
  
    // Print the header for the table:  
    PrintHeader(outPay);  
  
    // Print the table, line by line:  
    for (int count = 0; count < NumEmp; count++) {  
        outPay << setw( 6) << Emp[count].IdNum;  
        outPay << setw(12) << setprecision(2) << Emp[count].GrossPay;  
        outPay << setw(10) << setprecision(2) << Emp[count].FIT;  
        outPay << setw(10) << setprecision(2) << Emp[count].SSI;  
        outPay << setw(10) << setprecision(2) << Emp[count].InsFee;  
        outPay << setw(12) << setprecision(2) << Emp[count].NetPay;  
        outPay << endl;  
    }  
    // Calculate and print averages:  
    CalcAvg(outPay, Emp, NumEmp);  
}
```

```
////////////////////////////////////
// PrintHeader is used to print header for output file.
//
// Output Parameter (passed by reference):
//
//     outPay           output file stream variable
//
void PrintHeader(ofstream& outPay) {

    // no changes from ArrayPay.cpp
}

////////////////////////////////////
// CalcAvg is used to print final averages to input file.
//
// Output Parameter (passed by reference):
//
//     outPay           output file stream variable
//
// Input Parameters (passed by value):
//
//     Emp[]            array of employee records
//     NumEmployees     total number of employees
//
// Pre:  output file is open; Emp[] holds NumEmp records
// Post: if number of employees is positive, averages
//       have been printed; otherwise zeros are printed
//
void CalcAvg(ofstream& outPay, const EmpRec Emp[], int NumEmp) {

    double TotalGross = 0.0,    // total of all gross pay
           TotalNet   = 0.0,    // total of all net pay
           TotalIns   = 0.0,    // total of all insurance fees
           TotalSSI   = 0.0,    // total of all SS tax
           TotalFIT   = 0.0;    // total of all income tax
```

```
// Print out footer for table:
outPay << "======"
        << "======" << endl;

// If NumEmp > 0 then calculate totals and print out averages;
// otherwise print zeros for the averages.
//
if (NumEmp) {

    for (int count = 0; count < NumEmp; count++) {
        TotalGross += Emp[count].GrossPay;
        TotalIns   += Emp[count].InsFee;
        TotalFIT   += Emp[count].FIT;
        TotalSSI   += Emp[count].SSI;
        TotalNet   += Emp[count].NetPay;
    }
    outPay << " Avg:" << setprecision(2);
    outPay << setw(12) << TotalGross/NumEmp;
    outPay << setw(10) << TotalFIT/NumEmp;
    outPay << setw(10) << TotalSSI/NumEmp;
    outPay << setw(10) << TotalIns/NumEmp;
    outPay << setw(12) << TotalNet/NumEmp;
    outPay << endl;
}
else {
    outPay << " Avg:" << setprecision(2);
    outPay << setw(12) << 0.0;
    outPay << setw(10) << 0.0;
    outPay << setw(10) << 0.0;
    outPay << setw(10) << 0.0;
    outPay << setw(12) << 0.0;
    outPay << endl;
}
}
```

NamesPayA.cpp incorporates code to read, store and print the employee names already included in the input file. In addition, a second input file indicates which employees will receive a bonus (a 15% increase in gross pay). A sample second input file and output are provided below.

The employee names in the bonus file are followed immediately by a tab.

Sample (second) input and output files:

Employee	Bonus?
Checkov, Pavel	Y
Chewbacca	N
Kirk, James	N
McCoy, Leonard	Y
Rand, Janice	Y
Riley, Kevin	N
Scott, Montgomery	Y
Skywalker, Luke	N
Solo, Han	N
Spock	N
Sulu, Hikaru	N
Uhura	Y

```
Programmer: Bill McQuain
StarFleet Payroll
```

Name	IdNum	Gross Pay	FIT	SSI	Ins	Net Pay
Chewbacca	4297	1000.00	150.00	68.30	100.00	681.70
Rand, Janice	7077	1151.15	192.32	78.62	70.00	810.20
Skywalker, Luke	1716	2011.50	433.22	137.39	180.00	1260.89
Riley, Kevin	2334	2089.10	454.95	142.69	180.00	1311.47
Solo, Han	3424	2999.99	710.00	204.90	100.00	1985.09
Checkov, Pavel	5328	3450.00	858.50	235.63	180.00	2175.86
Sulu, Hikaru	3236	3897.89	1006.30	266.23	70.00	2555.36
Uhura	7641	5409.12	1505.01	369.44	180.00	3354.67
Scott, Montgomery	5956	6032.23	1710.64	412.00	250.00	3659.59
Spock	4098	8594.98	2556.34	587.04	140.00	5311.60
McCoy, Leonard	3175	8737.04	2603.22	596.74	100.00	5437.08
Kirk, James	5315	9336.00	2800.88	637.65	150.00	5747.47
Average		4559.08	1248.45	311.39	141.67	2857.58

```
////////////////////////////////////  
// Title:          Payroll Program with Employee Names  
// Programmer:     Bill McQuain  
// ID Number:      000-00-0000  
// Compiler:       Microsoft Visual C++ ver 6.0  
// Platform:       Pentium II 400, Windows NT  
// Last modified:  January 5, 1999  
//  
// Purpose:  
//  
// Same as the simple payroll program, Pay99.cpp; with two  
// extensions.  The employee names in the input file are no  
// longer ignored, and a second input file containing  
// employee bonus information is also processed.  
//  
// Implementation Issues:  
//  
// The only modifications from StructPay.cpp are related  
// to the inclusion of employee names and bonus flags.  To  
// accommodate that, a second array of structs is used to  
// hold bonus data, and a new function EarnedBonus() is used  
// to compare each employee's name to those in the bonus list  
// until a match is found, after which the bonus flag for  
// that employee is checked.  
//  
// Character data is handled in C-style, using char arrays  
// and the associated library functions from string.h.  
//  
#include <fstream.h>  
#include <iomanip.h>  
#include <string.h>          // to use strcmp() and strcpy()  
  
const int MaxEmp = 20;      // maximum number of employees  
const int NameLen = 35;     // maximum employee name length
```

```
typedef struct {
    int    IdNum;           // employee's ID number
    char   Name[NameLen];  // employee's name
    int    Age;            // employee's age
    char   InsPlan;        // employee's insurance plan code
    double GrossPay;       // employee's gross pay
    double InsFee;         // employee's insurance fee
    double FIT;            // employee's federal income tax
    double SSI;            // employee's social security tax
    double NetPay;         // employee's net pay
} EmpRec;

typedef struct {
    char Name[NameLen];    // employee name
    bool GetsBonus;        // true if yes, false if no
} BonusRec;

// Function prototypes:

void    InitRecords(EmpRec Emp[]);
void    ReadPayData(EmpRec Emp[], int& NumEmp);
void    ReadBonusList(BonusRec Bonus[]);
void    CalcData(EmpRec Emp[], BonusRec Bonus[], int NumEmp);
double  FedTax(double EmpGrossPay);
double  Insurance(char EmpInsPlan, int EmpAge);
bool    EarnedBonus(const char Name[], const BonusRec Bonus[],
                    int NumEmp);
void    SortData(EmpRec Emp[], int NumEmp);
void    PrintTable(const EmpRec Emp[], int NumEmp);
void    PrintHeader(ofstream& outPay);
void    CalcAvg(ofstream& outPay, const EmpRec Emp[],
                int NumEmp);
void    SkipWhiteSpace(ifstream& ifile);
```

```
////////////////////////////////////  
// Beginning of main function:  
//  
int main() {  
  
// Local variables for main():  
  
    EmpRec    Emp[MaxEmp];        // array of employee records  
    BonusRec  Bonus[MaxEmp];     // array of bonus records  
    int       NumEmp;            // number of employees  
  
// Initialize employee records:  
  
    InitRecords(Emp);  
  
// Read employee pay data and bonus list from input files:  
  
    ReadPayData(Emp, NumEmp);  
    ReadBonusList(Bonus);  
  
// Calculate employee withholding data and net pay:  
  
    CalcData(Emp, Bonus, NumEmp);  
  
// Sort the data so net pay amounts are in increasing order:  
  
    SortData(Emp, NumEmp);  
  
// Print the table of employee information:  
  
    PrintTable(Emp, NumEmp);  
  
    return NumEmp;  
}
```

```
////////////////////////////////////  
// The function ReadPayData reads employee data from the input  
// file and stores it in the array parameters. ReadData will  
// read until the end of the input file or until the arrays  
// are filled (determined by the global constant MaxEmp).  
//  
// Output parameters (passed by reference):  
//  
//   Emp[]      array of employee records  
//   NumEmp     number of employees for whom data was stored  
//  
//  
void ReadPayData(EmpRec Emp[], int& NumEmp) {  
  
    int    Index = 0;    // next array location to fill  
  
    int    empnum,      // temp storage for employee id number  
          empage;      //      employee age,  
    double gross;      //      gross pay,  
    char   plan;       //      insurance plan code, and  
    char   empname[NameLen]; //      name  
  
    ifstream inPay;          // input file stream  
  
    inPay.open("workers.dat"); // open input file  
  
    // Read first line of data from input file:  
  
    inPay >> empnum >> empage >> gross >> plan;  
  
    SkipWhiteSpace(inPay);    // skip whitespace after plan code  
    inPay.get(empname, NameLen); // read employee name
```

```
// Process and read next line until there's no more data or
// we've filled up the arrays:

while (inPay && Index < MaxEmp) {

    Emp[Index].IdNum    = empnum;    // Store the last input line
    Emp[Index].Age      = empage;    //           in an employee record
    Emp[Index].GrossPay = gross;
    Emp[Index].InsPlan  = plan;
    strcpy(Emp[Index].Name, empname);

    inPay.ignore(200, '\n');        // Skip to next line.

    inPay >> empnum >> empage >> gross >> plan;

    SkipWhiteSpace(inPay);        // skip whitespace after plan code
    inPay.get(empname, NameLen); // read employee name

    Index++;                      // Update index for next store
}

NumEmp = Index;                  // Remember: we never stored anything after
                                //           the last increment of Index

inPay.close();                  // Close the input file.
}
```

```
////////////////////////////////////  
// ReadBonusList reads list of employee names and flags  
// indicating whether each employee is to receive a bonus  
// during this pay period.  
//  
// Output parameter:  
// Bonus[] array of bonus records  
//  
void ReadBonusList(BonusRec Bonus[]) {  
  
    int count = 0;  
    char tmpName[NameLen];  
    char Flag;  
    ifstream inBonus;  
    inBonus.open("bonus.dat");  
  
    inBonus.ignore(80, '\n'); // skip header line  
  
    inBonus.get(tmpName, NameLen, '\t');  
    inBonus >> Flag;  
    SkipWhiteSpace(inBonus);  
    count++;  
  
    while (inBonus && count < MaxEmp) {  
  
        strcpy(Bonus[count].Name, tmpName);  
        Bonus[count].GetsBonus = (Flag == 'Y');  
  
        SkipWhiteSpace(inBonus);  
        inBonus.get(tmpName, NameLen, '\t');  
        inBonus >> Flag;  
        count++;  
    }  
    inBonus.close();  
}
```

```
////////////////////////////////////
// CalcData is used to calculate the net pay amounts for all
// employees.
//
// Input Parameters (passed by value):
//
//   NumEmp          number of employees to be processed
//
// Input/Output Parameters (passed by reference):
//
//   Emp[]           array of employee records
//
void CalcData(EmpRec Emp[], BonusRec Bonus[], int NumEmp){

    const double SSRate    = 0.0683;        // SSI tax rate
    const double BonusRate = 1.15;         // bonus factor

    //////////////////////////////////////
    // Calculate the insurance fee, income tax, social security
    // tax and net pay for each employee, storing the results in
    // the relevant arrays:
    //
    for (int count = 0; count < NumEmp; count++) {

        if (EarnedBonus(Emp[count].Name, Bonus, NumEmp))
            Emp[count].GrossPay = BonusRate * Emp[count].GrossPay;

        Emp[count].InsFee = Insurance(Emp[count].InsPlan,
                                      Emp[count].Age);
        Emp[count].FIT     = FedTax(Emp[count].GrossPay);
        Emp[count].SSI     = SSRate * Emp[count].GrossPay;
        Emp[count].NetPay  = Emp[count].GrossPay - Emp[count].FIT -
                            Emp[count].SSI - Emp[count].InsFee;
    }
}
```

```
////////////////////////////////////  
// Insurance is used to calculate the proper insurance fee  
// for an employee.  
//  
// Input Parameters (passed by value):  
//  
// Plan character 'B' or 'D', indicating plan selected  
// Age employee's age  
//  
// Return value:  
//  
// InsFee insurance fee charged to employee  
//  
float Insurance(char Plan, int Age) {  
  
// no changes from StructPay.cpp  
  
}  
  
////////////////////////////////////  
// FedTax is used to calculate the proper income tax.  
//  
// Input Parameter (passed by value):  
//  
// Gross employee's gross pay amount  
//  
// Return value:  
//  
// FIT income tax withheld for employee  
//  
float FedTax(double Gross) {  
  
// no changes from StructPay.cpp  
  
}
```

```
////////////////////////////////////  
// EarnedBonus checks the list of bonus information to see if  
// the employee Emp should receive a bonus.  
//  
// Input parameters:  
//  
// Name[]      name of employee  
// Bonus[]     array of bonus information  
// NumEmp     number of employees  
//  
// Returns true if bonus awarded, false if not.  
//  
bool EarnedBonus(const char Name[], const BonusRec Bonus[],  
                 int NumEmp){  
  
    for (int count = 0; count < NumEmp; count++) {  
  
        if (strcmp(Name, Bonus[count].Name) == 0) {  
            return Bonus[count].GetsBonus;  
        }  
    }  
    return 0;  
}
```

```
////////////////////////////////////  
// SortData sorts the array of NetPay amounts into increasing  
// order, rearranging the data in the other arrays to keep  
// everything consistent. The selection sort algorithm is used.  
//  
// Input Parameters (passed by value):  
//  
//     NumEmp      number of employees  
//  
// Input/Output parameters (passed by reference):  
//  
//     Emp[]       array of employee records  
//  
void SortData(EmpRec Emp[], int NumEmp) {  
  
// no changes from StructPay.cpp  
  
}
```

```
////////////////////////////////////  
// PrintTable is used to print the table of employee data to  
// output file.  
// Input Parameters (passed by value):  
//   Emp[]      array of employee records  
//   NumEmp     number of employees to print data for  
//  
void PrintTable(const EmpRec Emp[], int NumEmp) {  
  
    ofstream outPay;           // output file stream  
    outPay.open("payola.dat"); // open the output file  
  
                               // Set up for floating point output:  
    outPay.setf(ios::fixed, ios::floatfield);  
    outPay.setf(ios::showpoint);  
  
    // Print the header for the table:  
    PrintHeader(outPay);  
  
    // Print the table, line by line:  
    for (int count = 0; count < NumEmp; count++) {  
  
        outPay << Emp[count].Name;  
        int offset = 25 - strlen(Emp[count].Name);  
        outPay << setw(offset) << Emp[count].IdNum;  
        outPay << setw(12) << setprecision(2) << Emp[count].GrossPay;  
        outPay << setw(10) << setprecision(2) << Emp[count].FIT;  
        outPay << setw(10) << setprecision(2) << Emp[count].SSI;  
        outPay << setw(10) << setprecision(2) << Emp[count].InsFee;  
        outPay << setw(12) << setprecision(2) << Emp[count].NetPay;  
        outPay << endl;  
    }  
  
    // Calculate and print averages:  
    CalcAvg(outPay, Emp, NumEmp);  
}
```

```
////////////////////////////////////
// PrintHeader is used to print header for output file.
//
// Output Parameter (passed by reference):
//
//     outPay         output file stream variable
//
void PrintHeader(ofstream& outPay) {

// no changes from StructPay.cpp

}

////////////////////////////////////
// CalcAvgs is used to print final averages to input file.
//
// Output Parameter (passed by reference):
//
//     outPay         output file stream variable
//
// Input Parameters (passed by value):
//
//     Emp[]          array of employee records
//     NumEmployees   total number of employees
//
void CalcAvgs(ofstream& outPay, const EmpRec Emp[], int NumEmp) {

// no changes from StructPay.cpp

}
```

```
////////////////////////////////////  
//  InitRecords writes dummy values into the employee records,  
//  prior to processing of input.  
//  
//  Output parameter:  
//    Emp[]  array of employee records  
//  
void InitRecords(EmpRec Emp[]) {  
  
    for (int idx = 0; idx < MaxEmp; idx++) {  
        Emp[idx].IdNum      = 9999;  
        strcpy(Emp[idx].Name, "Singh, Khan");  
        Emp[idx].Age        = 150;  
        Emp[idx].InsPlan    = 'X';  
        Emp[idx].GrossPay   = 0.0;  
        Emp[idx].InsFee     = 0.0;  
        Emp[idx].FIT        = 0.0;  
        Emp[idx].SSI        = 0.0;  
        Emp[idx].NetPay     = 0.0;  
  
    }  
}
```

```
////////////////////////////////////  
// SkipWhiteSpace does just that --- reads the input file  
// stream ifile up to the next nonwhitespace character.  
//  
// Input/Output parameter:  
//   ifile   input file stream  
//  
void SkipWhiteSpace(ifstream& ifile) {  
  
    char ch;  
  
    ifile.get(ch);        // get first character  
  
    while (ch == ' ' || ch == '\t' || ch == '\n') {  
        ifile.get(ch);  
    }  
  
    ifile.putback(ch);    // last char read wasn't whitespace,  
                          // so put it back  
}
```

NamesPayS.cpp is a modification of NamesPayA.cpp to use Standard Library string objects rather than char arrays.

Accordingly, the new-style header files are incorporated.

Sample (second) input and output files:

Employee	Bonus?
Checkov, Pavel	Y
Chewbacca	N
Kirk, James	N
McCoy, Leonard	Y
Rand, Janice	Y
Riley, Kevin	N
Scott, Montgomery	Y
Skywalker, Luke	N
Solo, Han	N
Spock	N
Sulu, Hikaru	N
Uhura	Y

```
Programmer:  Bill McQuain
StarFleet Payroll
```

Name	IdNum	Gross Pay	FIT	SSI	Ins	Net Pay
Chewbacca	4297	1000.00	150.00	68.30	100.00	681.70
Rand, Janice	7077	1151.15	192.32	78.62	70.00	810.20
Skywalker, Luke	1716	2011.50	433.22	137.39	180.00	1260.89
Riley, Kevin	2334	2089.10	454.95	142.69	180.00	1311.47
Solo, Han	3424	2999.99	710.00	204.90	100.00	1985.09
Checkov, Pavel	5328	3450.00	858.50	235.63	180.00	2175.86
Sulu, Hikaru	3236	3897.89	1006.30	266.23	70.00	2555.36
Uhura	7641	5409.12	1505.01	369.44	180.00	3354.67
Scott, Montgomery	5956	6032.23	1710.64	412.00	250.00	3659.59
Spock	4098	8594.98	2556.34	587.04	140.00	5311.60
McCoy, Leonard	3175	8737.04	2603.22	596.74	100.00	5437.08
Kirk, James	5315	9336.00	2800.88	637.65	150.00	5747.47
Average		4559.08	1248.45	311.39	141.67	2857.58

```
////////////////////////////////////  
// Title:          Payroll Program using C++ strings  
// Programmer:     Bill McQuain  
// ID Number:      000-00-0000  
// Compiler:       Microsoft Visual C++ ver 5.0  
// Platform:       Pentium II 400, Windows NT  
// Last modified:  January 5, 1999  
//  
// Purpose:        no changes from NamesPayA.cpp  
//  
// Implementation Issues:  
//  
// This implementation is an alteration of the char array  
// implementation (NamesPayA.cpp). The only difference  
// is that this implementation uses the standard string  
// class instead of char arrays.  
//  
// The first modification is in the #include section,  
// where new-style header files are used, and a using  
// statement is added to incorporate the std namespace.  
//  
// In the global struct typedefs, the char array fields  
// are replaced by string fields.  
//  
// Other modifications occur in the two input functions,  
// where string objects are used for input purposes, and  
// in the bonus decision function.  
//  
#include <fstream>  
#include <iomanip>  
#include <string>  
using namespace std;  
  
const int MaxEmp = 20;      // maximum number of employees
```

```
typedef struct {
    int      IdNum;           // employee's ID number
    string   Name;           // employee's name
    int      Age;            // employee's age
    char     InsPlan;        // employee's insurance plan code
    double   GrossPay;       // employee's gross pay
    double   InsFee;         // employee's insurance fee
    double   FIT;           // employee's federal income tax
    double   SSI;           // employee's social security tax
    double   NetPay;         // employee's net pay
} EmpRec;

typedef struct {
    string   Name;           // employee name
    bool     GetsBonus;      // true if yes, false if no
} BonusRec;

// Function prototypes:

void  InitRecords(EmpRec Emp[]);
void  ReadPayData(EmpRec Emp[], int& NumEmp);
void  ReadBonusList(BonusRec Bonus[]);
void  CalcData(EmpRec Emp[], BonusRec Bonus[], int NumEmp);
double FedTax(double EmpGrossPay);
double Insurance(char EmpInsPlan, int EmpAge);
bool   EarnedBonus(string Name, const BonusRec Bonus[], int NumEmp);
void   SortData(EmpRec Emp[], int NumEmp);
void   PrintTable(const EmpRec Emp[], int NumEmp);
void   PrintHeader(ofstream& outPay);
void   CalcAvg(ofstream& outPay, const EmpRec Emp[], int NumEmp);
void   SkipWhiteSpace(ifstream& ifile);
```

```
////////////////////////////////////  
// Beginning of main function:  
//  
int main() {  
  
// Local variables for main():  
  
    EmpRec    Emp[MaxEmp];        // array of employee records  
    BonusRec  Bonus[MaxEmp];     // array of bonus records  
    int       NumEmp;            // number of employees  
  
// Initialize employee records:  
  
    InitRecords(Emp);  
  
// Read employee pay data and bonus list from input files:  
  
    ReadPayData(Emp, NumEmp);  
    ReadBonusList(Bonus);  
  
// Calculate employee withholding data and net pay:  
  
    CalcData(Emp, Bonus, NumEmp);  
  
// Sort the data so net pay amounts are in increasing order:  
  
    SortData(Emp, NumEmp);  
  
// Print the table of employee information:  
  
    PrintTable(Emp, NumEmp);  
  
    return NumEmp;  
}
```

```
////////////////////////////////////
// The function ReadPayData reads employee data from the input file a
// stores it in the array parameters. ReadData will read until the
// end of the input file or until the arrays are filled (determined
// by the global constant MaxEmp).
//
// Output parameters (passed by reference):
//
//   Emp[]           array of employee records
//   NumEmp          number of employees for whom data was stored
//
void ReadPayData(EmpRec Emp[], int& NumEmp) {

    int    Index = 0;    // next array location to fill

    int    empnum,      // temp storage for employee id number
           empage;     //      employee age,
    double gross;      //      gross pay,
    char   plan;       //      insurance plan code, and
    string empname;    //      name

    ifstream inPay;           // input file stream

    inPay.open("workers.dat"); // open input file

    // Read first data value from input file:

    inPay >> empnum;
```

```
// Process and read until there's no more data or
// we've filled up the arrays:

while (inPay && Index < MaxEmp) {

    inPay >> empage >> gross >> plan;
    SkipWhiteSpace(inPay);      // skip whitespace after plan code
    getline(inPay, empname, '\n');

    Emp[Index].IdNum    = empnum;      // Store the last input line
    Emp[Index].Age      = empage;      //      in an employee record
    Emp[Index].GrossPay = gross;
    Emp[Index].InsPlan  = plan;
    Emp[Index].Name     = empname;

    inPay >> empnum;

    Index++;      // Update index for next store
}

NumEmp = Index;  // Remember: we never stored anything after
                //      the last increment of Index

inPay.close();  // Close the input file.
}
```

```
////////////////////////////////////  
// ReadBonusList reads list of employee names and flags indicating  
// whether each employee is to receive a bonus during this pay  
// period.  
// Output parameter:  
//   Bonus[]      array of bonus records  
//  
void ReadBonusList(BonusRec Bonus[]) {  
  
    int    count = 0;           // number of data lines read  
    string Name;               // employee name  
    char   BFlag;              // bonus flag  
  
    ifstream inBonus;  
    inBonus.open("bonus.dat");  
    inBonus.ignore(80, '\n');   // skip header line  
                                // Priming read:  
    getline(inBonus, Name, '\t'); // read name and  
    inBonus >> BFlag;           // flag  
    inBonus.ignore(80, '\n');   // skip to next line  
    count++;                    // count data line  
  
    while (inBonus && count < MaxEmp) {  
  
        Bonus[count].Name = Name; // store bonus data  
        Bonus[count].GetsBonus = (BFlag == 'Y');  
  
        getline(inBonus, Name, '\t'); // repeat read logic  
        inBonus >> BFlag;  
        inBonus.ignore(80, '\n');  
        count++;                    // count data line  
    }  
    inBonus.close();  
}
```

```
////////////////////////////////////
// CalcData is used to calculate the net pay amounts for all
// employees.
// Input Parameters (passed by value):
//   NumEmp      number of employees to be processed
// Input/Output Parameters (passed by reference):
//   Emp[]       array of employee records
//
void CalcData(EmpRec Emp[], BonusRec Bonus[], int NumEmp){

    // no changes from NamesPayA.cpp
}
////////////////////////////////////
// Insurance is used to calculate the proper insurance fee
// for an employee.
// Input Parameters (passed by value):
//   InsPlan     character 'B' or 'D', indicating plan selected
//   Age         employee's age
// Return value:
//   InsFee      insurance fee charged to employee
//
float Insurance(char InsPlan, int Age) {

    // no changes from StructPay.cpp
}
////////////////////////////////////
// FedTax is used to calculate the proper income tax.
// Input Parameter (passed by value):
//   Gross       employee's gross pay amount
// Return value:
//   FIT         income tax withheld for employee
//
float FedTax(double Gross) {

    // no changes from StructPay.cpp
}
}
```

```
////////////////////////////////////  
// EarnedBonus checks the list of bonus information to see if  
// the employee Emp should receive a bonus.  
//  
// Input parameters:  
//  
// Name          name of employee  
// Bonus[]       array of bonus information  
// NumEmp        number of employees  
//  
// Returns true if bonus awarded, false if not.  
//  
bool EarnedBonus(string Name, const BonusRec Bonus[],  
                  int NumEmp){  
  
    for (int count = 0; count < NumEmp; count++) {  
  
        if ( Name == Bonus[count].Name ) {  
            return Bonus[count].GetsBonus;  
        }  
    }  
    return 0;  
}
```

```
////////////////////////////////////  
// SortData sorts the array of NetPay amounts into increasing  
// order, rearranging the data in the other arrays to keep  
// everything consistent. The selection sort algorithm is used.  
//  
// Input Parameters (passed by value):  
//  
//     NumEmp      number of employees  
//  
// Input/Output parameters (passed by reference):  
//  
//     Emp[]       array of employee records  
//  
void SortData(EmpRec Emp[], int NumEmp) {  
  
// no changes from StructPay.cpp  
  
}
```

```

////////////////////////////////////
// PrintTable is used to print the table of employee data to
// output file.
// Input Parameters (passed by value):
//   Emp[]          array of employee records
//   NumEmp         number of employees to print data for
//
void PrintTable(const EmpRec Emp[], int NumEmp) {

    ofstream outPay;           // output file stream
    outPay.open("payola.dat"); // open the output file
                                // Set up for floating point output:
    outPay.setf(ios::fixed, ios::floatfield);
    outPay.setf(ios::showpoint);

    // Print the header for the table:
    PrintHeader(outPay);

    // Print the table, line by line:
    for (int count = 0; count < NumEmp; count++) {

        outPay << Emp[count].Name;
        int offset = 25 - Emp[count].Name.length();
        outPay << setw(offset) << Emp[count].IdNum;
        outPay << setw(12) << setprecision(2) << Emp[count].GrossPay;
        outPay << setw(10) << setprecision(2) << Emp[count].FIT;
        outPay << setw(10) << setprecision(2) << Emp[count].SSI;
        outPay << setw(10) << setprecision(2) << Emp[count].InsFee;
        outPay << setw(12) << setprecision(2) << Emp[count].NetPay;
        outPay << endl;
    }

    // Calculate and print averages:
    CalcAvg(outPay, Emp, NumEmp);
}

```

```
////////////////////////////////////
// PrintHeader is used to print header for output file.
//
// Output Parameter (passed by reference):
//   outPay      output file stream variable
//
void PrintHeader(ofstream& outPay) {

    // no changes from StructPay.cpp
}
////////////////////////////////////
// CalcAvgs is used to print final averages to input file.
//
// Output Parameter (passed by reference):
//
//   outPay      output file stream variable
//
// Input Parameters (passed by value):
//
//   Emp[]       array of employee records
//   NumEmployees total number of employees
//
void CalcAvgs(ofstream& outPay, const EmpRec Emp[], int NumEmp) {

    // no changes from StructPay.cpp
}
////////////////////////////////////
// SkipWhiteSpace does just that --- reads the input file
// stream ifile up to the next nonwhitespace character.
//
// Input/Output parameter:
//   ifile      input file stream
//
void SkipWhiteSpace(istream& ifile) {

    // no changes from StructPay.cpp
}
```

```
////////////////////////////////////  
//  InitRecords writes dummy values into the employee records,  
//  prior to processing of input.  
//  
//  Output parameter:  
//      Emp[]  array of employee records  
//  
void InitRecords(EmpRec Emp[]) {  
  
    for (int idx = 0; idx < MaxEmp; idx++) {  
        Emp[idx].IdNum      = 9999;  
        Emp[idx].Name       = "Singh, Khan";  
        Emp[idx].Age        = 150;  
        Emp[idx].InsPlan    = 'X';  
        Emp[idx].GrossPay   = 0.0;  
        Emp[idx].InsFee     = 0.0;  
        Emp[idx].FIT        = 0.0;  
        Emp[idx].SSI        = 0.0;  
        Emp[idx].NetPay     = 0.0;  
  
    }  
}
```