Solved Problem [1]

```
// This program shows how to find the average of the elements in an array.
#include <iostream>
#include <iomanip>
using namespace std;
int main()
{
  const int NUM_QUIZZES = 10;
  int grade[NUM_QUIZZES]; // The array to store the quiz grades
  int quiz,               // The array subscript
      grade_sum = 0;
  double grade_avg;
  cout << setprecision(1)
       << setiosflags(ios::fixed)
       << setiosflags(ios::showpoint);
  cout << "Please enter " << NUM_QUIZZES
       << " integer quiz grades." << endl << endl;
  for (quiz = 0; quiz < NUM_QUIZZES; ++quiz)
  {
    cout << endl;
    cout << "Enter grade for quiz " << quiz + 1 << ": ";
    cin >> grade[quiz];
  }
  cout << endl;
  cout << "The grades you entered are:";
  for (quiz = 0; quiz < NUM_QUIZZES; ++quiz)
    cout << setw(5) << grade[quiz];
  for (quiz = 0; quiz < NUM_QUIZZES; ++quiz)
    grade_sum += grade[quiz];
  grade_avg = double(grade_sum) / NUM_QUIZZES;
  cout << endl << endl;
  cout << "The average quiz grade is " << grade_avg << endl;
  return 0;
}
```

Program Output

```
Please enter 10 integer quiz grades.
Enter grade for quiz 1: 55
Enter grade for quiz 2: 66
Enter grade for quiz 3: 77
Enter grade for quiz 4: 88
Enter grade for quiz 5: 99
Enter grade for quiz 6: 100
Enter grade for quiz 7: 100
Enter grade for quiz 8: 99
Enter grade for quiz 9: 88
Enter grade for quiz 10: 77
The grades you entered are:   55  66  77  88  99
   100  100  99  88  77

The average quiz grade is 84.9
```

Solved problem [2]

```
// This program uses a two-dimensional array to store the quiz grades of students in
// several classes.  The program then calculates the average quiz grade of each student.
#include <iostream>
#include <iomanip>
using namespace std;
int main()
{
  const int NUM_QUIZZES = 10;
  const int NUM_STUDENTS = 5;

  int class_grades[NUM_STUDENTS][NUM_QUIZZES];
  int student,
      quiz,
      quiz_sum;
  double quiz_average;
  cout << setprecision(1)
       << setiosflags(ios::fixed)
       << setiosflags(ios::showpoint);
  // Obtain and store the quiz grades for each student
  cout << "Enter exactly " << NUM_QUIZZES
       << " quiz grades for each student." << endl;
  cout << "Separate the grades by one or more spaces." << endl;
  for (student = 0; student < NUM_STUDENTS; ++student)
  {
    cout << endl << endl;
    cout << "Grades for Student " << student + 1 << ": ";
    for (quiz = 0; quiz < NUM_QUIZZES; ++quiz)
      cin >> class_grades[student][quiz];
  }
  // Calculate and display the average quiz grade for each student
  for (student = 0; student < NUM_STUDENTS; ++student)
  {
    quiz_sum = 0;
    for (quiz = 0; quiz < NUM_QUIZZES; ++quiz)
      quiz_sum += class_grades[student][quiz];
      quiz_average = (double) quiz_sum / NUM_QUIZZES;
      cout << endl << endl;
      cout << "Student: " << setw(3) << student + 1
           << "   Quiz Average: " << setw(5) << quiz_average;
  }
  cout << endl;
  return 0;
}
```

Program Output

```
Enter exactly 10 quiz grades for each student.
Separate the grades by one or more spaces.
Grades for Student 1: 50 56 87 67 98 90 68 54 67 30
Grades for Student 2: 70 68 64 78 97 57 68 90 67 74
Grades for Student 3: 64 76 87 67 95 67 56 83 60 78
Grades for Student 4: 76 65 84 47 86 65 46 66 87 65
Grades for Student 5: 76 57 65 45 90 76 76 44 67 82
Student:   1   Quiz Average:  66.7
Student:   2   Quiz Average:  73.3
Student:   3   Quiz Average:  73.3
Student:   4   Quiz Average:  68.7
Student:   5   Quiz Average:  67.8
```

Exercises

[1] Is there anything wrong with the following `for` loop that attempts to add each element of `arr_1[]` to the corresponding element of `arr_2[]` and place the result in the corresponding element of `arr_3[]`?

```
for (i = 0; i < 7; ++i)
        arr_3[i] = arr_1[i] + arr_2[i];
```

[2] What does the following code display?

```
int arr[9];
int i;
for (i = 0; i < 9; ++i)
        arr[i] = i + 3;
cout << endl;
for (i = 0; i < 9; ++i)
        cout << setw(4) << a[i];
cout << endl << endl;
for (i = 8; i >= 0; --i)
        cout << setw(4) << a[i];
```

[3] Use the following declarations

```
double d_array[10] = {3.4, 12.8, 9.5, 2.0, 1.7, 3.8};
char letters[26];
int i;
```

[4] Write a `for` loop to display only the elements of `d_array[]` having an even subscript.

[5] Write a `for` loop to display only the first element of `d_array[]` that is less than 3.0.

[6] Write a `for` loop that sets each element of `letters[]` to a blank

[7] Write a `for` loop that places the lowercase letters of the alphabet into the array `letters[]`.

[8] Declare a two-dimensional array that contains 15 rows, each of which will store 12 integers.

[9] Use the following declarations

```
int arr_2d[3][4] = {{4, 5, 6, 7},
                    {2, 6, 1},
                    {8, 7, 2, 1}};
int row, col;
```

[10] What are the values of `arr_2d[2][2]`, `arr_2d[0][0]`, `arr_2d[3][4]`, and `arr_2d [1][3]`?

[11] Execute the following program and explain what it displays.

```
#include <iostream>

using namespace std;
int main()
{
  int arr_3d[4][3] = {{1},
                      {1, 2},
                      {1, 2, 3},
                      {1, 2, 3, 4}};
  int row, col;
  for (row = 0; row < 4; ++row)
  {
    cout << endl;
    for (col = 0; row < 3; ++col)
      cout << setw(3) << arr_3d[row][col];
  }
  return 0;
}
```

Programming Problems

[1] Bluebird Airlines has flights from Phoenix to six other cities in Arizona. The cities are referred to by number, 1 to 6. The price for a round-trip ticket to each of the cities is shown here.

City	1	2	3	4	5	6
Price	56.79	105.69	93.49	155.99	87.49	73.99

Write a program that computes the total price of tickets that a customer orders. The program should prompt the user for the number of the destination city and the number of tickets desired. If the user enters an invalid city number, the program should display an error message and terminate. The program should display the total price of the ticket order. Use an array to store the ticket price table.

[2] A bookstore owner wants you to write a program to calculate the store's weekly payroll. The store's employees are paid hourly. Overtime is to be paid at the rate of 1.5 times the normal rate for hours an employee worked over 40. The program should prompt the user to enter the number of hours the employee worked and the pay rate for the employee. The program should display the regular pay, overtime pay, and gross pay for that employee. Then the program should prompt the user to enter the data for another employee. When the user responds that there are no more employees to process, the program should display the number of employees it processed and the total payroll, that is, the sum of the gross salaries of the employees.

The program should validate the pay rate as it is entered. The only valid hourly pay rates are the following: 5.50, 6.00, 6.50, 6.75, 7.00, 7.25, 7.50, 7.75, 8.00. Store the rates in an array. When a pay rate is entered, search the array for a match. If there is a match, continue the rest of the calculations. If there is no match, display an error message, a list of the valid pay rates, and prompt for another pay rate

[3] A survey organization telephones 20 homes and records the household income of each family surveyed. Write a program that inputs the 20 incomes into an array and then sorts the array into decreasing order. The program should display the following statistics: the maximum income, the minimum income, the average income, and the median income. The median of a set of sorted numbers is the middle number, if there is an odd number of numbers. If there is an even number of numbers, the median is the average of the two middle numbers.

[4] A sweatshirt manufacturer wants to take inventory of the college logo sweatshirts that it has in stock. The company makes sweatshirts for seven colleges. Refer to the colleges by number, 17. Sweatshirts come in four sizes: small, medium, large, and x-large. An employee gathers the inventory information by hand. Write a program that prompts the employee to enter the number of sweatshirts in stock for each of the seven colleges in each of the four sizes. Store the inventory information in a two-dimensional array. After inputting the inventory data, the program should display an inventory report in the following format.

```
                                        Inventory Report
                                              College
                        1    2    3    4    5    6    7     Total
      Small
      Medium
Size
      Large
      XLarge
College Total

Total Quantity On Hand
```

At the end of each row should be the total inventory for that size. At the bottom of each column should be total inventory of each college. The Total Quantity On Hand should be the total inventory of all sweatshirts.