

Open book and notes. Show all of your work clearly in the space provided or on the additional page at the end of the exam. If the additional page is used, be sure to clearly label the content for each problem. Be sure to *read each problem carefully*. You should answer all 5 questions, and if you have time, you may wish to attempt the bonus problem. Note that the exam is double sided.

1. Consider the following function:

```
int exam2(int Days, double Price)
2 {
  static string x="Q";
4   x += "q";
   cout << Days << x << Price;
6 }
```

a) (5 points) Briefly, and in your own words, describe how the `static` keyword in the following function affects the object `x`.

b) (10 points) What will the `cout` statement in the function produce if it is called for the third time by: `exam2(6, 123.00);`? Note: If it is not possible to determine the output without knowing the parameters of the first two function calls, just write: *Insufficient data*. (Explain your reasoning for partial credit.)

2. (20 points) Consider the following C++ program:

```
1 #include <iostream>
2 #include <string>
3 using namespace std;
4
5 void Exam2(int i, int j)
6 {
7     int temp = i;
8     i = j;
9     j = temp;
10    cout << "f: i = " << i << endl;
11    cout << "f: j = " << j << endl;
12    return;
13 }
14
15 int main ()
16 {
17     int a = 10;
18     int b = 20;
19     Exam2(a, b);
20     Exam2(b, a);
21     cout << "main: a = " << a << endl;
22     return 0;
23     cout << "main: b = " << b << endl;
24 }
```

What would you expect the output of this program to be? (Show your work for partial credit.)

3. (15 points) If it is possible, re-write the following **for** loop using a **while** loop instead. If it is not possible, explain why it is not possible.

```
for(int i=3243; i>15; i-=3) {  
2   cout << i;  
}
```

4. (20 points) Write a function called `Shift` that will accept three integers, `a`, `b`, and `c`, and shift the values such that:  $a = b$ ,  $b = c$ , and  $c = a$ .



5. (30 points) Each day for the past 23 years, your crazy uncle Ivan has been keeping track of high temperature (in degrees Fahrenheit), maximum wind speed (in mph), and the average relative humidity (in percent). He recently bought a computer and has entered all of his data into a data file called “`weather.txt`”. The data file has temperature in the first column, wind speed in the second, and relative humidity in the third. The first three lines of the input file are shown below.

Uncle Ivan has asked you to calculate the wind chill index. The wind chill index is the perceived temperature when taking additional weather related factors into account. The U.S. National Weather Service has provided the following approximated formula for calculating the wind chill:

$$\text{WCIndex} = 91.4 - 0.47(1 - 0.043\text{wind} + 0.64\sqrt{\text{wind}})(91.4 - \text{Temp})$$

This equation is valid for wind speeds between 4 and 40 mph. There is little wind chill effect for wind speeds below 4 mph, and there is little *additional* effect for wind speeds greater than 40 mph. Write a program that will read in the data, calculate the wind chill factor, and write to a file called “`weather.out`” the three original columns of data *and* a fourth column containing the wind chill factor.

weather.txt			weather.out			
21.3	2.0	65	21.3	2.0	65	21.3
5.6	15.8	88	5.6	15.8	88	-24.1
8.3	59.0	23	8.3	59.0	23	-38.6



**bonus** (10 points) Assume that you have two functions available to you that compute the wind chill factor and the heat index given the appropriate data. The function prototypes are:

```
double WindChill(double Temp, double Wind, double Humid);  
2 double HeatIndex(double Temp, double Wind, double Humid);
```

Further assume that the perceived temperature is computed

- using the wind chill factor for temperatures below 50 degrees and
- using the heat index for temperatures 50 degrees and higher.

Write a program that will read in Uncle Ivan's data file from problem 5 and will write the perceived temperature in the fourth column of an output file called "weather.bon". (The first three columns should contain the original data.)



Additional work area for any problem. Clearly identify to which problem the work on this page is related.