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Test #2 **CS 120**

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Answer questions as indicated. Closed book/Closed Notes. NO PDAs (phones, calculators, handheld devices, etc.) allowed.

1 Basic Concepts—20 points

Circle the correct answer. If you are using pen and decide you have circled the wrong answer, **write** the word *True* or *False* to the right. Each problem in this section is worth 2 points.

Problem 1.	C++ is an interpreted language.	True	False
Problem 2.	C++ is case sensitive.	True	False
Problem 3.	Function prototypes serve no purpose.	True	False
Problem 4.	Functions can be defined inside other functions.	True	False
Problem 5.	A programmer needs to know how a function is implemented in order to use it.	True	False
Problem 6.	All variables used in a function must be declared inside the function.	True	False
Problem 7.	All variables must be initialized before they can be used.	True	False
Problem 8.	All variables used in a function must be be declared in the function prototype.	True	False
Problem 9.	`3_r` is a valid variable name.	True	False
Problem 10.	A `return` statement allows one or more variables to be returned from a function.	True	False

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2 Short Answer—15 points

Each problem in this section is worth 5 points. Be specific!

Problem 12. What is the difference between a function definition and a function prototype?

Prototype — interface for the compiler.
Definition — actual behavior.
An example shows some of the difference.

Problem 13. Why is program design so important?

Direction. A blueprint/roadmap.

Problem 14. Why is testing so important?

Make sure the function works properly.

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3 Program Analysis—10 points

Problem 15. What is output by the following program? **Show All Work!**

```
//  test2.cpp
#include <iostream>

using namespace std;

int func( int a, int b );

int main()
{
    int  j = 3;

    for( int i = 2 ; i <= 6 ; i += 2 )
    {
        j = func( i, j );
    }

    return 0;
}

int func( int a, int b )
{
    if( b-a%3 > 2 )
        cout << "B  I: " << ++a << " " << b++ << endl;
    else
        cout << "B II: " << a-- << " " << --b << endl;
    return a;
}
```

Solution:

```
B II: 2 2 4
B II: 4 0 3
B  I: 7 3 3
```

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4 C++ Programming—35 points

There are no I/O operations in the functions unless specified. Describe any/all assumptions. Arrays/Objects may not be used unless specified.

Problem 16. (7 points) Write a single function that will convert a single uppercase letter to lowercase *without* using any library functions. There is no I/O in function. Hint: Recall that lower and upper case letters are each located in sequential order in the ASCII character set.

```
_____ ToLower( _____ ch )
{
    char newChar = ch;

    if( ____ <= ch && ch <= _____ )  // check upper only
    {
        int n = ch - ______;         // offset

        newChar = _____ + n;
    }

    _____  newChar;
}
```

```
char ToLower( char ch )
{
    char newChar = ch;

    if( 'A' <= ch && ch <= 'Z' )  // check upper only
                                  // if( IsUpper(ch) )
    {
        int n = ch - 'A';         // offset

        newChar = 'a' + n;
    }

    return  newChar;
}
```

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Problem 17. (8 points) Write a function to convert (replace) tabs to commas in a string (character array). There is no I/O in the function.

```
______  TabsToCommas( _____ s[] )
{
   int i = ___;

      // Process each character in string
   _____( s[i] != _____ )
   {
      if( s[i] ____ '\t')
          s[i] ____ ',';

      ____   // increment index
   }

   s[i] = '\0';
}
```

```
void  TabsToCommas( char s[] )
{
   int i = 0;

   while( s[i] != '\0' )
   {
      if( s[i] == '\t' )
          s[i] = ',';

      i++;
   }

   s[i] = '\0';
}
```

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Problem 18. (10 points) Write a single function (not `main()`) that counts and returns the number of positive and negative values in an array of integer values. No external functions may be used. There is no I/O in the function.

Prototype (2 points)

```
void  CountEvenOdd( int A[], int nA, int& pos, int& neg );
```

Implementation (8 points)

```
void  CountEvenOdd( int A[], int nA, int& pos, int& neg )
{
    pos = neg = 0;

    for( int i = 0 ; i < nA ; i++ )
    {
        if( A[i] > 0 )
            pos++;
        else
            neg++;
    }

    //  could also count one and do math:
    pos = nA - neg;  // or
    neg = nA - pos;
}
```

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Problem 19. (10 points) *Write a function* (not `main()`) that finds *and returns* the product of the specified column of a two dimensional array of real (floating point) values (the values are passed to the function in a two dimensional array).

NOTE: Global variables may be used only for the array dimensions.

Prototype (2 points)

```
double ProdColumn( const double A[][MAX_COLS],
                   const int nRows, const int iCol );
```

Implementation (8 points)

```
double ProdColumn( const double A[][MAX_COLS],
                   const int nRows, const int iCol )
{
    double product = 1.0;   // Must be 1.0

    for( int i = 0 ; i < nRows ; i++ )
    {
       product *= A[i][iCol];
    }

    return product;
}
```