(1) Consider the following function declaration:

```c
int sum(int);
```

The function `sum` should take as input an integer `n` and return the value 0 if `n <= 0`. If `n > 0`, the value returned should be the sum `1+2+3+...+(n-1)+n` of the first `n` positive integers. Write the definition of the function `sum` in the space below.
(2) Consider the following function declaration:

\[ \textbf{int num_days (int);} \]

This function should take as input an integer \( m \) and return the number of days in month \( m \) in a non leap year. (For January, \( m \) is 1, and for February \( m \) is 2 and so forth.) If \( m \) is not a valid number of a month, \textit{num_days} should return 0. So if \( m \) is 1, 3, 5, 7, 8, 10 or 12, \textit{num_days} should return 31. If \( m \) is 2, \textit{num_days} should return 28. If \( m \) is 4, 6, 9 or 11, \textit{num_days} should return 30. And otherwise \textit{num_days} should return 0.

Write the function definition in the space below:
(3) Consider the following program. Write the output of the program in the space given below.

```cpp
#include <iostream.h>
int f(int);  
void main()
{
    cout << f(3) << endl;
}
int f(int m){
    cout << m << " ";
    if (m)
        return m + f(m-1);
    else
        return 0;
}
```

(4) Mark each of the following logical expressions as either true or false. You can assume we have declared

```plaintext
int x=1, y=2, z=4;
```

<table>
<thead>
<tr>
<th>Expression</th>
<th>true</th>
<th>false</th>
</tr>
</thead>
<tbody>
<tr>
<td>(x&gt;=1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(z==y*y)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>((z&lt;5)</td>
<td></td>
<td>(y+x&lt;z))</td>
</tr>
<tr>
<td>(!x==1) &amp;&amp; (y==2))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(y==++x)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(5) Consider the following program. What is the output? Put your answer in the space below.

```cpp
#include<iostream.h>
void main() {
    int a=3, x=2;
    do{
        cout << a << " " << x << endl;
        if (a==1) a--;
        a--;
        x += a*a;
    } while ((a!=0) && (x<9));
}
```

(6) What is the output? Write your answer in the space below.

```cpp
#include<iostream.h>
void rotate (int&, int&, int&);
void main() {
    int a=1, b=2, c=3;
    rotate(a,b,c);
    cout << a << " " << b << " " << c << endl;
}
void rotate (int& x, int& y, int& z){
    int temp = x;
    x = y; y = z; z = temp;
}
```
Multiple choice: circle the letter of the correct answer.

(7) What is the returned value of the function \( f \)?

\[
int f(int x, int y)\{return (x>y) ? x : y; \}
\]

(a) The sum \( x + y \).
(b) The difference \( x - y \).
(c) The maximum of \( x \) and \( y \) (i.e. the value of the larger of \( x \) and \( y \)).
(d) The minimum of \( x \) and \( y \) (i.e. the value of the smaller of \( x \) and \( y \)).

(8) Consider a function \( g \) which itself does not output anything to the screen. If \( g \) is sent into an infinite recursion, what will happen upon execution on pegasus?

(a) The computer will print an error message to the screen and return to the pegasus prompt.
(b) The computer will do nothing.
(c) The computer will hang (it will appear to do nothing and will not return to the pegasus prompt).
(d) The computer will start to smoke.

(9) The following code fragment prints out _____ asterisks.

\[
for (char c='a'; c <= 'd'; c++) cout << '*';
\]

(a) 0
(b) 2
(c) 3
(d) 4

(10) Consider the following program. What is the output?

```cpp
#include<iostream.h>
void main(){
    bool a=false;
    for (int b=1; b<=3; b++){
        a = !a;
        if (a) cout << '+';
    }
    if (a) cout << '-';
}
```

(a) ++
(b) +-+
(c) ++-
(d) +
Consider the following functions:

```c++
void spaces(int m)
{
    for (int i=1; i<=m; i++) cout << " ";
}
void line(int m)
{
    for (int i=1; i<=m; i++) cout << "*";
    cout << endl;
}
```

Which code fragment prints out the following pattern?

```
*****
*   *
*   *
*   *
*****
```

(a)  line(5);
     for (int i=1; i<=4; i++){
         cout << "*"; spaces(3); cout << "*" << endl;
     }
     line(5);

(b)  line(5);
     for (int i=1; i<=3; i++){
         cout << "*"; spaces(3); cout << "*";
     }
     line(5);

(c)  line(5);
     for (int i=1; i<=3; i++){
         cout << "*"; spaces(3); cout << "*" << endl;
     }
     line(5);

(d)  line(5);
     for (int i=1; i<=3; i++){
         cout << "*"; spaces(4); cout << "*";
     }
     line(5);
(12) What is wrong with the following function definition?

void f(int n);
{
    while (n!=0) {
        n--;
        cout << n << endl;
    }
}

(a) Nothing.
(b) It is possible for this function to go into an infinite loop.
(c) There should not be a semicolon after `void f(int n)`.
(d) Both (b) and (c).

(13) In the following function definition, choose the keyword to fill in the blank so that the variable `a` is initialized to 1 the first time `f` is called, but after any return from `f`, the value of `a` is kept until the next time `f` is called:

```c
void f(){
    ____________________ int a = 1;

    . . . body of the function . . .

}
```

(a) `global`
(b) `static`
(c) `const`
(d) `keep`
Answers:

(1) int sum (int n){
    int i, s = 0;
    for (i = 1; i <= n; i++)
        s += i;
    return s;
}

(2) int num_days (int m){
    switch (m) {
        case 1: case 3: case 5: case 7: case 8: case 10: case 12:
            return 31;
        case 4: case 6: case 9: case 11:
            return 30;
        case 2:
            return 28;
        default:
            return 0;
    }
}

(3) 3 2 1 0 6
(4) true, true, true, false, true
(5) 3 2
    2 6
    1 7
    -1 8
(6) 2 3 1
(7) (c)
(8) (a)
(9) (d)
(10) (c)
(11) (c)
(12) (d)
(13) (b)