

## Answers

1. (10 points) What is printed by this program?

```
#include <iostream>
#include <string>

int main()
{
    int m = 6;
    int i = 2;

    for(i=0;i<m;i+=2)
        cout << "-";

    do
    {
        cout << "+";
        --i;
    }
    while (i>m and i >= 0);

    cout << endl;

    return 0;
}
```

ANSWER:

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2. (10 points) What is printed by this program?

```
#include <iostream>
#include <string>

int main(int argc, char *argv[])
{
    cout << argv[0][1] << endl;
    return 0;
}
```

ANSWER:

This prints out the second character of the program file path (if the file path is at least two characters long). If the path is only one character long, then what is the null character.

In C++ `main(int argc, char *argv[])`, the program file path is stored in `argv[0]`. For instance, if the executable for the above program is named `myprog`, and the user typed:

```
myprog
```

then the above program would print the character 'y'.

If the user typed

```
/home/ugrad/hhacker/myprog
```

then the above program would print the character 'h'.

If the user typed

```
./myprog
```

then the above program would print the character '/'.

3. (15 points) For each of the following pairs of functions, which one has the larger rate of growth and why?

(a)  $n \log n$  or  $(n^2 - 1)(n + 3)$

(b)  $6n^5 + 2n^2$  or  $n^2 + 5n + 10^6$

(c)  $2^n$  or  $(n + 1)(n \log n)$

ANSWERS:

(a)  $(n^2 - 1)(n + 3)$ , because  $O(n^3)$  has a larger rate of growth than  $O(n \log n)$

(b)  $6n^5 + 2n^2$ , because  $O(n^5)$  has a larger rate of growth than  $O(n^2)$

(c)  $2^n$ , because  $O(2^n)$  has a larger rate of growth than  $O(n^2 \log n)$ .

4. (15 points) What is printed by this program?

```
#include <iostream>
#include <cmath>
#include <vector>

void f(vector<double> &x, vector<double> y)
{
    for(size_t i=0;i<x.size();++i)
        y.push_back(x[i]);

    for(size_t i=0;i<x.size();++i)
        x.pop_back();
}

int main()
{
    vector<double> a(3);
    vector<double> b(3);

    for(size_t i=0;i<a.size();++i)
        a[i] = 2.0*static_cast<double>(i);

    for(size_t i=0;i<b.size();++i)
        b[i] = static_cast<double>(i);

    f(a,b);

    cout << b.size() << endl;
    cout << a.size() << endl;

    return 0;
}
```

ANSWER

3

1

5. (15 points) What is printed by this program?

```
#include <iostream>

int main()
{
    int i=2, j=9, k=-3;
    double a=6.6;

    cout << static_cast <int>(a) * i << endl;
    cout << k % i << endl;
    cout << a / i << endl;
    cout << j / i << endl;
    cout << (-k++) % i << endl;
    return 0;
}
```

ANSWER

12  
-1  
3.3  
4  
1

6. (15 points) What is printed by this program?

```
#include <iostream>
#include <string>

int b(int n, int k)
{
    assert(n>=0);
    assert(k>=0);

    if(n==0 or k==0)
        return 1;
    else if(n==k)
        return 1;
    else
        return b(n, k-1) + b(n-1,k-1);
}

int main()
{
    int m=4;

    for(int i=0;i<=m;++i)
        cout << b(i,m) << endl;
}
```

ANSWER

1  
4  
6  
4  
1

7. (10 points) What is printed by this program?

```
#include <iostream>
#include <cmath>

int main()
{
    double a=6.0;
    int b=9;
    bool test = true;

    if(test)
    {
        double a = sqrt(b);
        cout << a << endl;
        b = 6;
    }

    cout << a << endl;

    for(int b=0;b<2;++b)
        cout << b << endl;

    cout << b << endl;

    return 0;
}
```

ANSWER

3  
6  
0  
1  
6

8. (10 points) What is printed by this program?

```
#include <iostream>
#include <string>

int main()
{
    string s = "Hello World!";

    for(size_t i=0;i<s.length();++i)
        switch(s[i])
        {
            case 'i':
            case 'o':
            case 'u':
            case 'y':
                cout.put('!');
            case 'a':
            case 'e':
                cout.put('!');
            break;
            default:
                cout.put(s[i]);
            break;
        }
    cout << endl;
    return 0;
}
```

ANSWER

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