

Suppose that the program to the right is compiled into the executable `a.out`. In questions 1 through 3, please tell me the output of that command when typed into the shell. If the output is multiple lines, simply type it on one line separated by spaces.

**Question 1:** `echo 1 6 | ./a.out | tail -n 1`

**Question 2:** `echo 2 2 | ./a.out | tail -n 1`

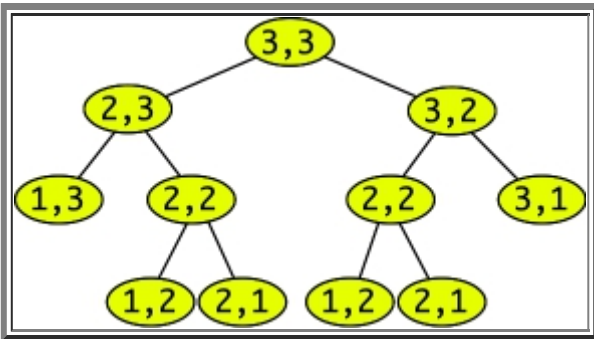
**Question 3:** `echo 2 3 | ./a.out | head -n 3`

**Question 4:** The tree drawn below represents the recursive calls that are made when you do the following:

```
echo 3 3 | ./a.out | tail -n 1
```

What kind of traversal would you use on this tree to calculate what gets printed?

**Question 5:** What is the output? (Use the tree)



```
#include <vector>
#include <iostream>
using namespace std;

int a(int b, int c)
{
    cout << b << ", " << c << endl;
    if (b == 1 || c == 1) return c*b;
    return a(b-1,c) * a(b,c-1);
}

int main()
{
    int b, c, ans;

    cin >> b >> c;

    ans = a(b,c);
    cout << ans << endl;
    return 0;
}
```

## Answers to the Clicker Questions

- **Question 1:** It returns  $1*6 = 6$  instantly.
- **Question 2:**  $a(2,2)$  calls  $a(1,2)$  and  $a(2,1)$  and returns their product. Both  $a(1,2)$  and  $a(2,1)$  return 2, so the answer is 4.
- **Question 3:**  $a(2,3)$  calls  $a(1,3)$ , which returns 3, and then  $a(2,2)$ . So the answer is "2,3 1,3 2,2".
- **Question 4:** You calculate the answer with a postorder traversal -- only after you have the return values of  $a(b-1,c)$  and  $a(b,c-1)$  can you calculate your return value.
- **Question 5:** Here's the tree filled out with the values from the postorder traversal. The answer is 144.

