

AP COMPUTER SCIENCE A – HOMEWORK #11

When you multiply binomials together (by distributing), you are actually multiplying together all the possible combinations of terms. So, you can multiply the binomials together just by looking at the combinations.

For example, if you run program `TestCombination` with $n = 2$, the output is

```
2C1 = 2
0
1
2C2 = 1
01
```

When one expands a factored second-order polynomial, one obtains

$$\begin{aligned} (x-a) * (x-b) = & \\ & x^2 \\ - (a+b) * x & \\ + (ab) & \end{aligned}$$

(1)

Note that the ${}_2C_1$ combinations correspond to the coefficient $(a+b)$, and that the ${}_2C_2$ combination corresponds to the (ab) coefficient.

Similarly, if you run program `TestCombination` with $n = 3$, the output is

```
3C1 = 3
0
1
2
3C2 = 3
01
02
12
3C3 = 1
012
```

and if one expands a factored third-order polynomial, one obtains

$$\begin{aligned} (x-a) * (x-b) * (x-c) = & \\ & x^3 \\ - (a+b+c) * x^2 & \\ + (ab+ac+bc) * x & \\ - (abc) & \end{aligned}$$

(2)

Here, the ${}_3C_1$ combinations correspond to $(a+b+c)$; the ${}_3C_2$ combinations correspond to $(ab+ac+bc)$; and the ${}_3C_3$ combination, to (abc) .

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Finally, running program `TestCombination` with $n = 4$ gives

```

4C1 = 4
0
1
2
3
4C2 = 6
01
02
03
12
13
23
4C3 = 4
012
013
023
123
4C4 = 1
0123

```

and expanding a factored fourth-order polynomial gives

$$\begin{aligned}
 &(x-a) * (x-b) * (x-c) * (x-d) = \\
 &\quad x^4 \\
 &- (a+b+c+d) * x^3 \\
 &+ (ab+ac+ad+bc+bd+cd) * x^2 \\
 &- (abc+abd+acd+bcd) * x \\
 &+ (abcd)
 \end{aligned}$$

(3)

Once again, $(a+b+c+d)$ corresponds to the ${}_4C_1$ combinations; $(ab+ac+ad+bc+bd+cd)$, to the ${}_4C_2$ combinations; $(abc+abd+acd+bcd)$, to the ${}_4C_3$ combinations; and $(abcd)$, to the ${}_4C_4$ combination.

At this point the pattern should be clear.

In any case, write a class `Polynomial.java` which has a constructor with signature `public Polynomial (int n)`, and which has a `public String toString ()` method that returns a `String` in the form of items (1), (2), (3), *etc.* The class `TestPolynomial.java`, containing the `main` method, will be used as-is.

Once your program is working correctly, email your file `Polynomial.java` to me at sharren@d131.org.