Groshong Algorithms Lab 3

Implement the DP version of MCM algorithm. Show commented code.

I used the pseudocode from the book in combination with explanations and code examples from geekforgeek, and sanfoundry and a video from youtube to refresh how it works. I have a terrible time with keeping track of nested for loops when using them to fill a table. The pseudocode is what I relied on but it also messed with me since I always forget they start arrays from 1 which I always forget.

```
/**
 * Calculate the minimum number of multiplication for various matrix sizes.
 * @return minimum number of multiplications
 */
public static int matrixChainOrder() {
    n = p.length - 1;

    // let m[1...n, 1..n] and s[1..n-1, 2..n] be new tables
    m = new int[n][n];
    s = new int[n][n];

    for (int i = 0; i < n; i++) {
        m[i][i] = 0;
    }

    for (int l = 1; l < n; l++) { // l is the chain length

        for (int i = 0; i < n - l; i++) {
            int j = i + l;

            m[i][j] = Integer.MAX_VALUE; // infinity

            // check each location in table using the values from other cells.
            for (int k = i; k < j; k++) {
                 int q = m[i][k] + m[k + 1][j] + p[i]* p[k + 1] * p[j + 1];

                 if (k == i) {
                    m[i][j] = q;
                    s[i][j] = k;
                }

                else if (k == i + 1) {
                    if (m[i][j] > q) {
                        m[i][j] = q;
                        s[i][j] = k;
                    }
                }

                else {
                    if (q < m[i][j]) {
                        m[i][j] = q;
                        s[i][j] = k;
                    }
                }
            }

            if (l == p.length - 2) {
                return m[i][j];  // return minimum value
            }
        }
    }
    return -1;  //abandon all hope ye who enter here.
}
```

Show the output for your DP version of MCM algorithm for p being < 30, 4, 8, 5, 10, 25, 15>, including where the parenthesis should be located.

```
p<30 4 8 5 10 25 15 >

The minimal multiplication is: 4660
The parentheses are placed: ( 30 (((( 4  8 ) 5 ) 10 ) 25 ))
```