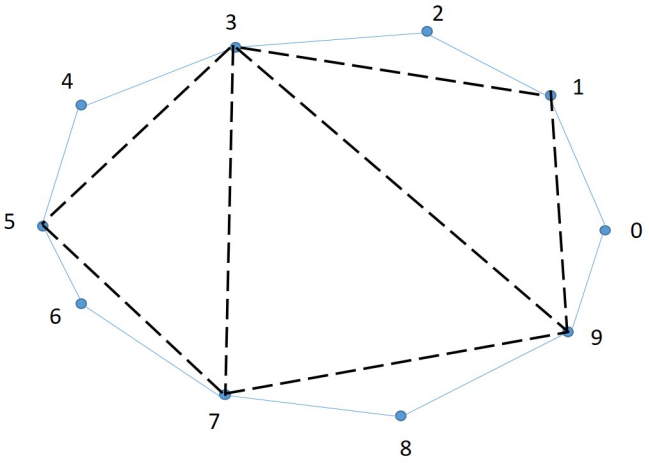
CS 405: Algorithm Analysis II
Homework 4: Polygon Decomposition

The following figure depicts a 10-vertex convex polygon decomposed into triangular areas. A decomposition involves a selection of non-intersecting chords, that is, intersecting only at the polygon vertices, that divide the polygon into triangles. The challenge is to find a decomposition such that the sum of the triangle perimeters is minimum. Proceeding counterclockwise around the figure, starting with the rightmost vertex, the vertex coordinates (x, y) are as shown to the right of the figure.



Vertex	x	y
0	202.1177	93.5606
1	177.3577	159.5286
2	138.2164	194.8717
3	73.9028	189.3758
4	17.8465	165.4303
5	2.4919	92.5714
6	21.9581	45.3453
7	72.9884	3.1700
8	133.3893	-0.3667
9	184.0190	38.2951

Vertices are identified by their position in the input list, starting with vertex 0. Chords are identified as a vertex pair (a, b) with $a < b$. Letting v denote this array of vertices, my program finds the minimal decomposition as

```
Minimal sum of triangle perimeters =  2528.5090
7 chords are:
    1    9
    1    3
    3    9
    3    7
    7    9
    3    5
    5    7
Check: twice sum(chords) + poly perimeter =  2528.5090,
```

Your assignment is to construct a dynamic programming algorithm to find the minimal decomposition of a convex polygon. The program output should follow the example output above. That is, it should declare the minimal triangle perimeter sum and the chords used to achieve that sum, followed by the check calculation.

A file called polygon1.txt contains the data in the example above, and you can use it to check the validity of your program. The file polygon2.txt contains a 25-vertex polygon in the same format.

Your email submission should include a .zip file containing your exported Eclipse project, a copy of the program output on polygon2.txt, and a .pdf writeup explaining how your solution achieves $\Theta(n^3)$ asymptotic complexity (or better). If you are not using the Eclipse IDE, submit all of the .java files that you use in your solution. I will use these files to build an Eclipse project in order to check out your solution.