

Group Project: Minimal-Cost Path through a Hexagonally-Tiled Map

Define a *Rectangular 233-Hexagon Array* to be the following array of 233 hexagonal tiles:

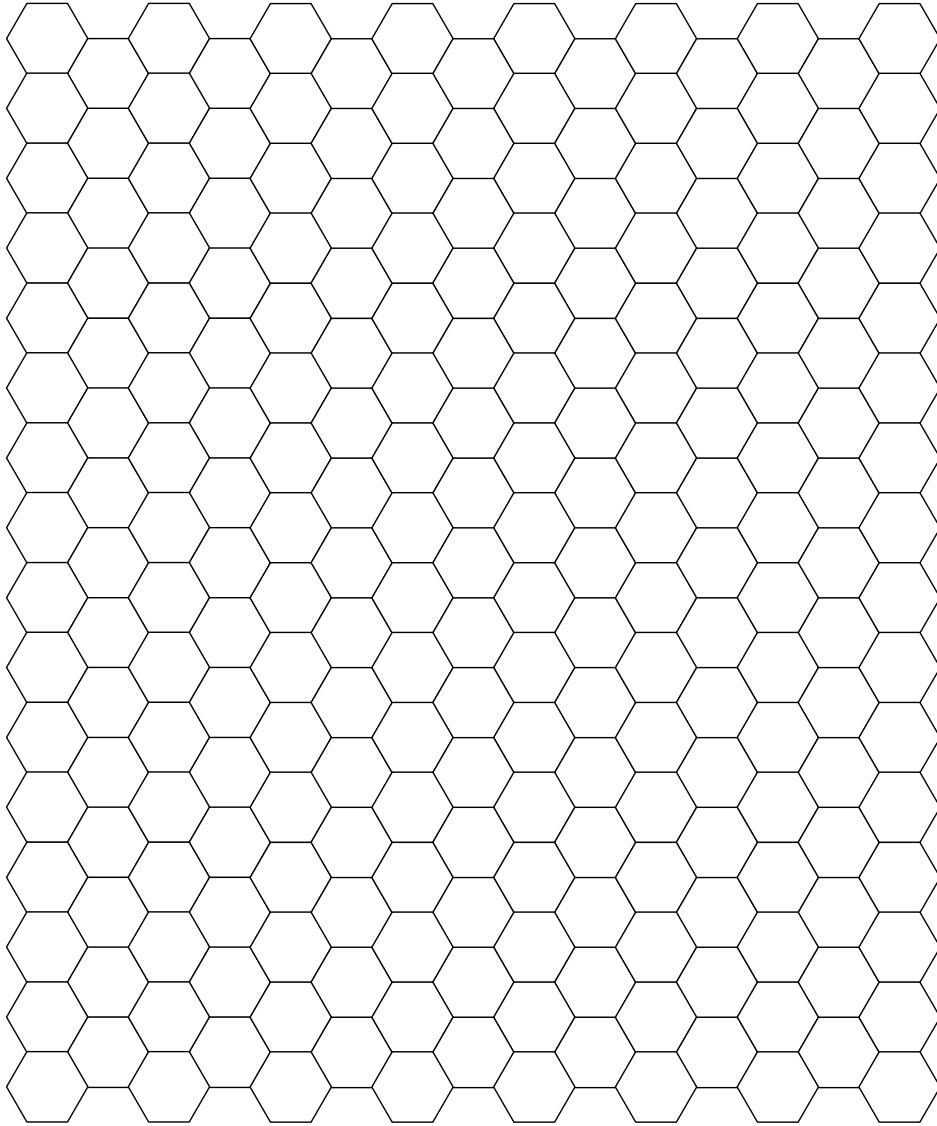


Figure 1: Rectangular 233-Hexagon Array

(continued)

Define a **Rectangular 233-Hexagon Map** to be a Rectangular 233-Hexagon Array in which each hexagon is assigned either a positive integer value (referred to as that hexagon's *cost*), or the value -1 . For example, the following is a Rectangular 233-Hexagon Map:

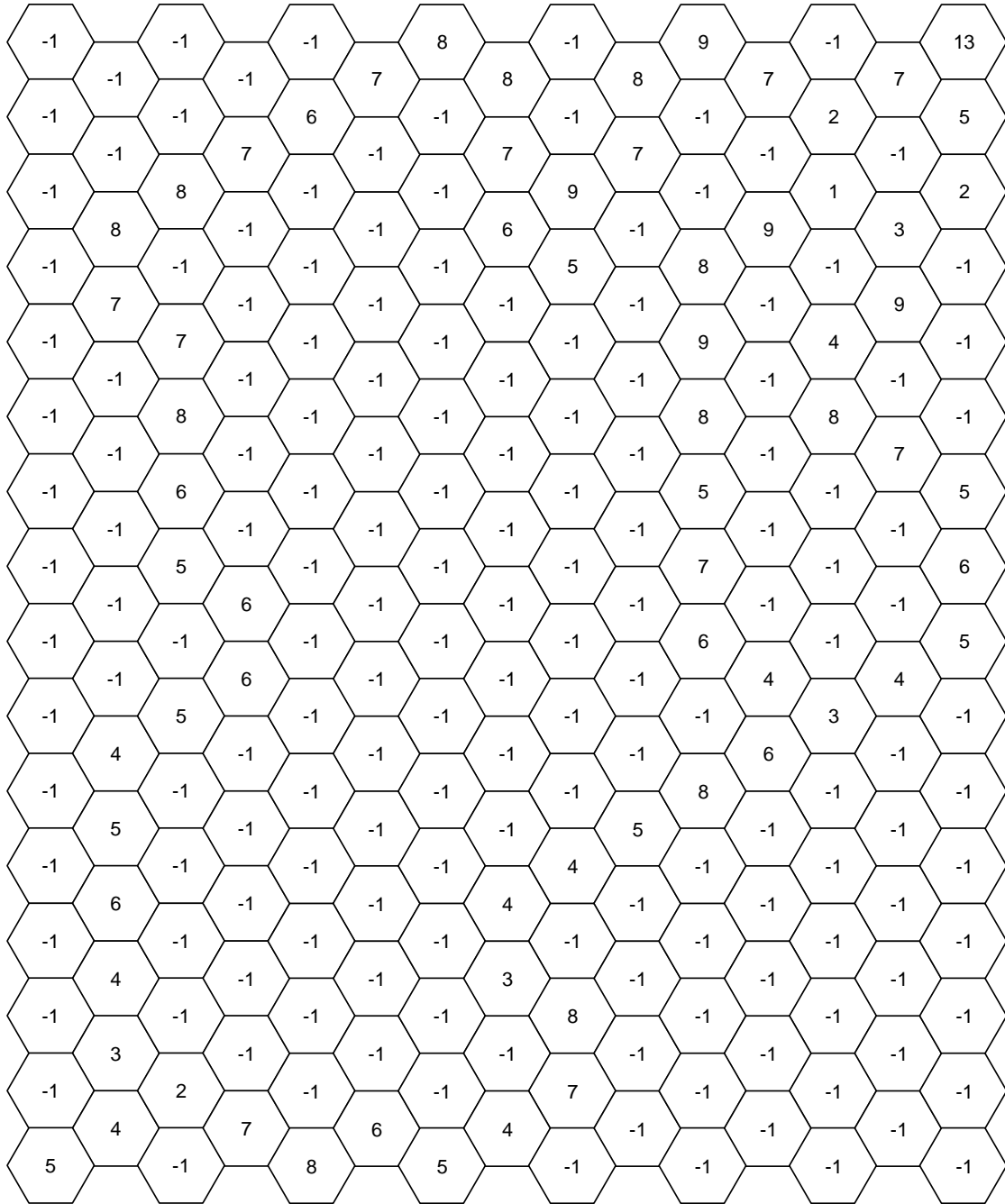


Figure 2: Example of a Rectangular 233-Hexagon Map

(continued)

To represent a Rectangular 233-Hexagon Map as a text file we first number the hexagon positions in the underlying Rectangular 233-Hexagon Array as follows:

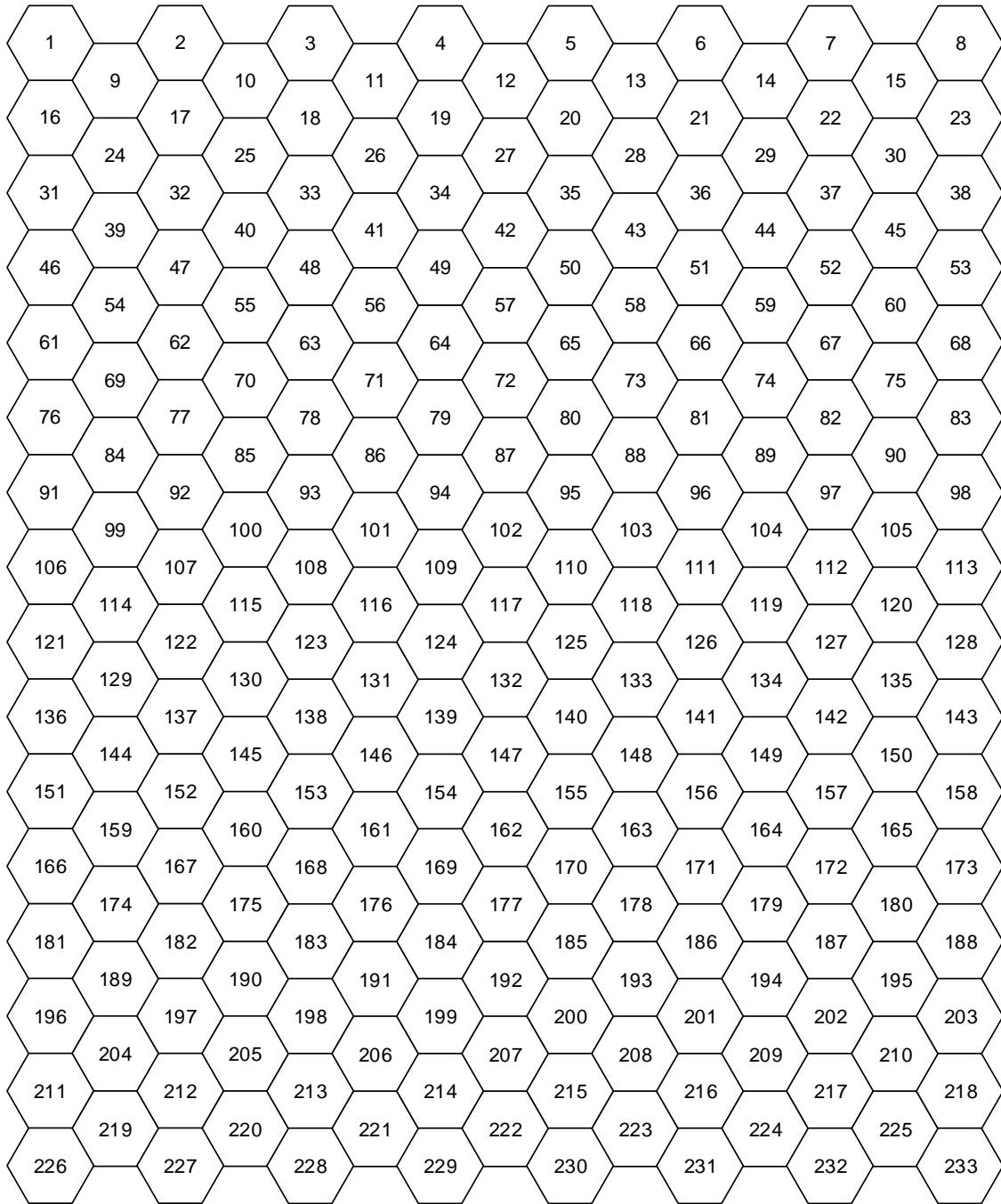


Figure 3: Position Numbering Scheme for Rectangular 233-Hexagon Array

(continued)

The text file describing the Rectangular 233-Hexagon Map then consists of 233 lines of text, each line of which consists of a hexagon position number from the diagram above, followed by a space, followed by the cost of that hexagon in the Rectangular 233-Hexagon Map that the text file is to represent. For example, the text file describing the Rectangular 233-Hexagon Map shown in Figure 2 would be:

```

1    -1
2    -1
3    -1
4     8
5    -1
6     9
7    -1
8    13
9    -1
10   -1
11    7
12    8
13    8
14    7
15    7
.
.
.
219   4
220   7
221   6
222   4
223  -1
224  -1
225  -1
226   5
227  -1
228   8
229   5
230  -1
231  -1
232  -1
233  -1

```

Figure 4: Text File Representation for Rectangular 233-Hexagon Map (Figure 2)

(continued)

A **path** through a Rectangular 233-Hexagon Map is a sequence of hexagon position numbers (see Figure 3) such that the first position number in the sequence is 226 (the lower left-hand corner of the Rectangular 233-Hexagon Map), the last position number in the sequence is 8 (the upper right-hand corner of the Rectangular 233-Hexagon Map), consecutive position numbers in the sequence correspond to adjacent positions in the Rectangular 233-Hexagon Array, and no hexagon on the path has value -1 . For example, the shaded portion of the following Rectangular 233-Hexagon Map depicts a path (note: hexagons with value -1 are in black)...

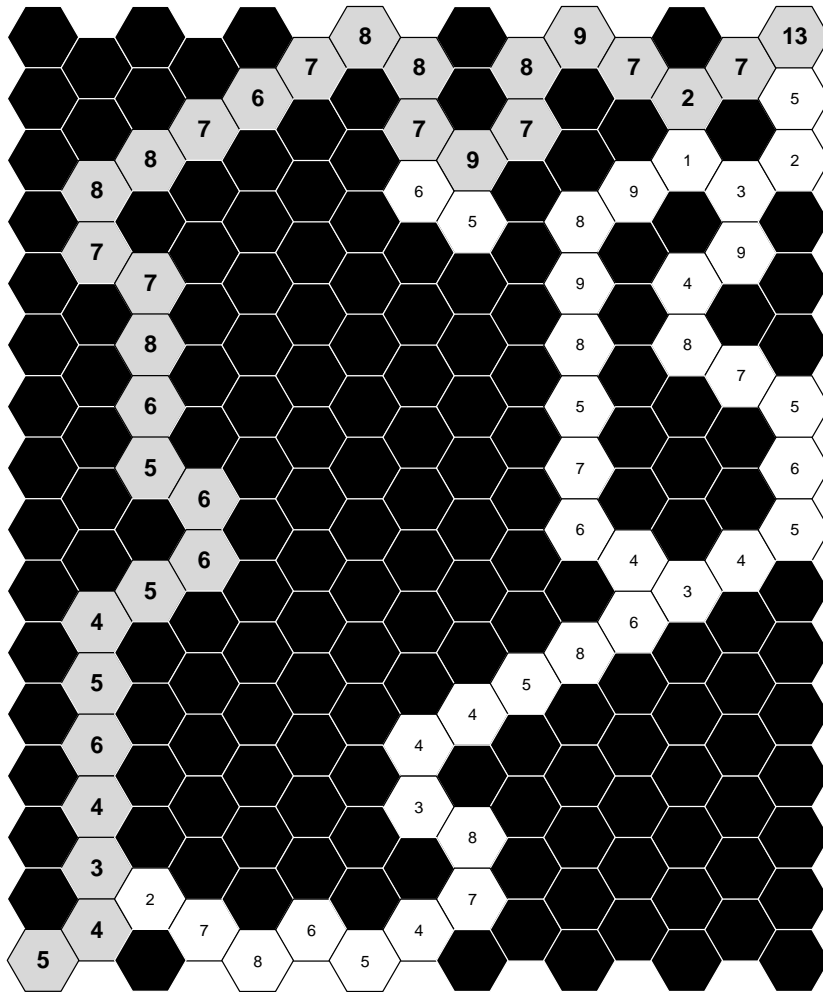


Figure 5: Example of a Path

...with position number sequence: 226, 219, 204, 189, 174, 159, ..., 13, 6, 14, 22, 15, 8. The **cost of a path** is defined to be the sum of the costs of the hexagons on the path. A **minimal-cost path** through a given Rectangular 233-Hexagon Map is a path such that no other path through that Rectangular 233-Hexagon Map has lower cost. Note that a Rectangular 233-Hexagon Map may have more than one minimal-cost path.

(continued)

The Assignment

Design an algorithm to find a minimal-cost path through a given Rectangular 233-Hexagon Map. Implement your algorithm as a Windows-compatible computer program which, given as input the text file representation of a Rectangular 233-Hexagon Map, produces as output a text file containing (one per line) the sequence of hexagon position numbers comprising a minimal-cost path through that Rectangular 233-Hexagon Map followed by a line containing the (positive integer) cost of that path preceded by the string "MINIMAL-COST PATH COSTS: ".

For example, the following figure depicts a minimal-cost path for the Rectangular 233-Hexagon Map in Figure 2:

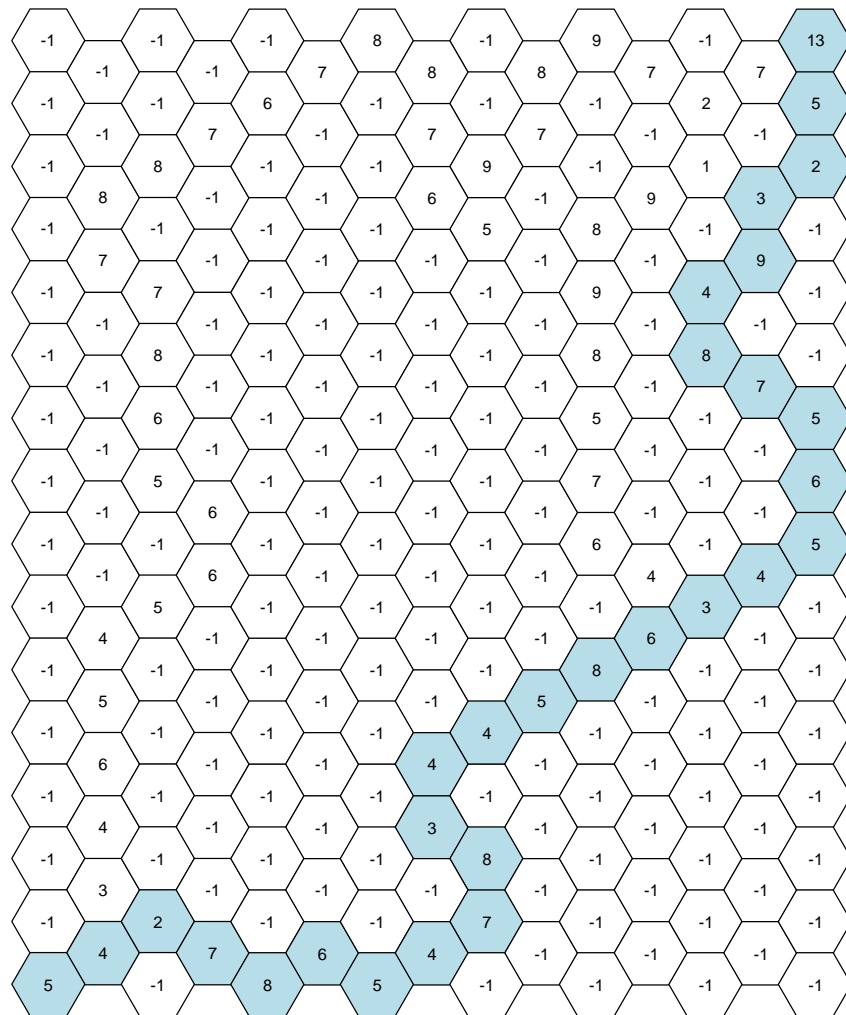


Figure 6: Minimal-Cost Path Corresponding to Figure 2

(continued)

For the above case, your program's output should be a text file containing the following:

```
226
219
212
220
228
221
229
222
215
200
192
177
170
163
156
149
142
135
128
113
98
90
82
67
60
45
38
23
8
MINIMAL-COST PATH COSTS: 160
```

Figure 7: Correct Program Output Corresponding to Figure 2

(continued)

Due Dates, Project Demo, etc.

Your group must turn in complete source code for your program (as printed hardcopy, not in electronic form) at the beginning of the last class meeting (4pm on Thursday, May 3).

Your group must demo its program by appointment during Finals Week. Appointments will be scheduled during class on Thursday, March 15.

All demos will be conducted at the GMCS 425 computer lab. At your demo appointment the instructor will provide your group with a USB thumb drive in the root directory of which resides a text file named INPUT.TXT containing a text representation (in the format shown in Figure 4) of a Rectangular 233-Hexagon Map. Your group – using either one of the lab's PC's or a laptop supplied by your group – must then execute your group's program using that input file to produce an output file describing (in the format shown in Figure 7) a minimal-cost path through that Rectangular 233-Hexagon Map.

If your program fails to complete execution within 30 seconds, or if your program completes execution within 30 seconds but produces incorrect output, each member of your group will receive no credit (zero points) for the project.

If your program completes execution within 30 seconds and produces correct output, each member of your group will receive full credit (100 points) for the project.

