Lab 7 :: DecoderBot

Due: See Website for details.

Academic Honesty: You may work with others to help solve the problem (or sub-problems) but you must write your own code.

Background:
1. Before you start this lab make sure you know about chars and strings and how to manipulate them – should be in your notes.

2. The Math class that comes with Java has a number of helpful static functions. Among them, Math.pow(int base, int exp), will be particularly useful for this assignment. For example, if you wanted to calculate $2^7$, Math.pow(2, 7) would give you the result.

The Problem:
You encounter a world that has been encoded with beepers. The code represents a string of characters. Each character is encoded by placing some pattern of beepers in a 7-street column, that spans streets 8-2. An encoded message, therefore, is represented as a left-to-right series of encoded columns that are 7 streets high. (This way a longer message will just extend further to the east where there’s room to expand).

Here is how the column is encoded: Each column represents a number that is the UNICODE/ASCII integer for some character. Each of the 7 streets that make up the column represent a successive power of 2 that should be added to the resulting number. Starting with street 8, a beeper on street 8 adds $2^6$, a beeper on street 7 adds $2^5$, a beeper on street 6 adds $2^4$, .... a beeper on street 2 adds $2^0$. (This is a binary encoding scheme). The figure below should add clarity.

```
  9
 8 2^6
 7 2^5
 6 2^4
 5 2^3
 4 2^2
 3 2^1
 2 2^0
 1

The column depicted here represents the number...

$2^6 + 2^4 + 2^3 + 2^1 + 2^0 = 64 + 16 + 8 + 2 + 1 = 91$

Another way to think of calculating it is by multiplying the number of beepers on each corner (0 or 1) by the power of 2 it represents:

$1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 91$
```
Once you’ve calculated a number for the column, you must convert that into the ASCII character it represents and compose a string of all the characters. Your job is to decode an entire message. In decoding your message you must ensure the following:

1.) The original beepers that made up the message must remain where they are (you may pick them up and put them back down if necessary, as long as the original message is there at the end).

2.) You must place a pile of beepers on street 1 underneath each column; the size of the pile is the number represented by the code above it.

3.) You must print the final message as output to the console; it must be the LAST thing printed to the console.

Example:
**Strategy:**
You should do some significant planning and thinking about how you want to tackle this. Your life will be *significantly* easier if you think about using multiple robots to complete simple tasks.

- Identify the sub-problems and smaller tasks that make up the larger problem.
- Think about simple robots you could design (that might use other simple robots) to complete each task. Remember there is no *real* cost for creating, using, and forgetting about LOTS of robots. (You will see slightly better performance (maybe) if you turnOff a robot when you’re done using it – you may also want to set it invisible so your world doesn’t get cluttered).
- Make one robot at a time, test it on a simple set of sub problems (like, make your own worlds to test it), confirm that it works and then move on.

**Turning it in:**
NOTE: See website for due date and time.

On the day that the assignment is due, you will declare what kind of message you want (see below) and I will send you a world file with an encoded message. You will have five (5) minutes to load the world file, decode the message, and do what it says! In other words, your decoder robot better work, and it better work quickly.

**Requirements:**

Part 1 (required):
Being able to decode a 20-character message is the minimum requirement for this assignment. If the characters in message are fewer than 20, it will be padded with spaces.

Part 2 (optional):
Decoding an arbitrarily sized message is slightly harder. In a larger message, the end of the message will be signified by a an empty column of beepers.

Part 3 (optional):
Encode a response message. You may elect to respond to the message I send you by sending back your own encoded message. To do this you will need to clear out the world, encode your message and save the world. Read the World class documentation to see how to do this.