**APCS :: Activity - Fun with Loops (Beeper Patterns)**

**Pair Programming Lab**

**Goal:**
Your goal is to write code to produce the worlds shown below using loops. The second purpose of this assignment is to get comfortable using the static World methods and also to learn to write your own static methods.

You should **download the starting code** from the web site. Problem 1 is done for you as an example of what you should produce.

**Rules:**
1. You and your partner must take turns at the keyboard: one person will type, the other will observe and make suggestions. At the very least, you must switch typist/observer positions for each problem – you may switch more frequently if you like.

2. You must write all of your methods into the class given to you as starting code. Each method, when called, should produce one of the Worlds shown below.

3. The examples all show a 10x10 world with the pattern. However, your methods should work to solve the arbitrarily large or small case by having your method accept parameters as inputs and resizing the world dynamically – the sample solution for problem 1 shows this.

4. Also, more credit will be awarded if your method achieves the pattern by only doing “one pass” over the world – only “touching” each corner once. Some of the patterns are easier if you do multiple passes, but all can be done with one pass.

5. You should complete as many of the patterns as you have time for. You don’t have to do them in any particular order. Your final program should contain only methods for the problems you completed successfully. All method should be called “problemN” where N is the problem number.

**NOTES:**
Almost all the patterns will involve using nested loops (probably for-loops) and if-statements (that have compound Boolean expressions) within those loops. In analyzing a pattern it’s often helpful to consider the street and avenue numbers as a pair and look for a pattern or mathematical relationship that makes the pair.
Problems:

1. Create an NxN world with a single row of beepers on the middle street.

2. Create an NxN world with a single row of beepers on the middle avenue.

3. Create an NxN world with a single row of beepers on the middle street where the number of beepers on each corner is equal to the avenue number.

4. Create an NxN World with a line of beepers going diagonally from 1,1 to N,N

5. Create an NxN World with a line of beepers going diagonally from N,1 to 1,N.
6. Create an NxN World with an X-pattern. Even and odd N are shown for clarity.

7. Create an NxN world with beepers on every corner EXCEPT the diagonal from 1,1 to N,N.

8. Create an NxN World with beepers on every corner EXCEPT the corners that make a centered “X” shape. Even and odd N shown for clarity.
9. Create an NxN World where beepers are placed to make an asterisk (*) pattern. Odd N will look better than even N for this one. Both are shown for clarity.

10. Create an NxN World where beepers make an upward-pointing arrow. NOTE: there is a beeper on every street. The Pattern becomes more clear for large N, and odd N looks a little better because you get a singular point. Both small and large N are shown for clarity, with an even number chosen for the large N to show what it might look like.
11. The mirror of problem 10. Same restrictions.

12. Create an NxN World with a centered diamond shape. NOTE: only needs to work for odd N.