



Problem of the Week

Problem E

Squirrel!

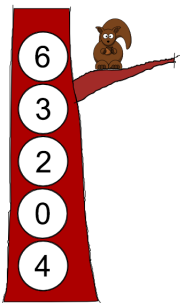
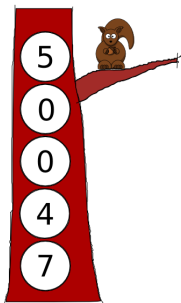
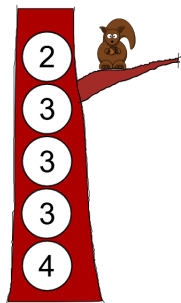
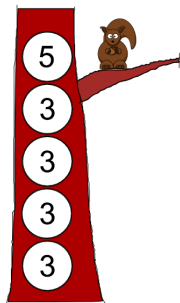
Some squirrels live in a tree with five big holes located one above the other. Every day, in the morning, each squirrel counts the number of **other** squirrels in their present hole and how many squirrels are in the adjacent holes above and below their present hole.

Every night, each squirrel secretly either stays where they are or moves to a hole above or below their current hole. A squirrel in the lowest hole can only choose to stay in the lowest hole or move up one hole. A squirrel in the highest hole can only choose to stay in the highest hole or move down one hole. The squirrels move independently and make their moves according to the following rules:

1. If the number of **other** squirrels in their present hole is less than the **total** number of squirrels in either the hole above or the hole below them, then the squirrel stays where it is.
2. If the number of **other** squirrels in their present hole is the same as the **total** number of squirrels in the hole above them, then the squirrel moves up. If the number of **other** squirrels in their present hole is the same as the **total** number of squirrels in the hole below them, then the squirrel stays where it is. Squirrels always prefer to live higher in trees.
3. If the number of **other** squirrels in their present hole is more than the **total** number of squirrels in either the hole above or the hole below them, then the squirrel moves to the hole which gives them the fewest number of **other** squirrels than their present hole. In the event that there are the same number of squirrels in each choice, remember that squirrels prefer to live higher in trees.

Each day these rules are applied until all of the squirrels are in the same hole. In some instances this will never happen!

For each of the following scenarios, determine the number of days from the initial day that it takes until all of the squirrels are in the same hole. The number in each circle represents the **total** number of squirrels in each hole on the initial day. The solution to the example scenario is given on the following page.

Example Scenario	Scenario 1	Scenario 2	Scenario 3
			





Solution to Example Scenario

Initial Day	Day 1	Day 2	Day 3

- Initial Day to Day 1

Each of the 6 squirrels in the top hole currently have 5 others with them. If they were to move down, each squirrel would move to the hole with 3 others. So each of these 6 squirrels moves down from the top hole.

Each squirrel in the second hole from the top currently has 2 others with them. If they were to move up, they would move to the hole with 6 others. If they were to move down, they would move to the hole with 2 others, the same as they have now. Since they like to be higher in the tree, they will stay where they are rather than moving down.

Each squirrel in the third hole from the top currently has 1 other with them. If they were to move up, they would move to the hole with 3 others. If they were to move down, they would move to the hole with 0 others. The choice is clear, they will move down one hole.

Each squirrel in the bottom hole currently has 3 others with them. If they were to move up, they would move to the hole with 0 others. The choice is clear, they will move up one hole.

The result of all the decisions is shown in the Day 1 diagram above.

- Day 1 to Day 2

Each squirrel in the second hole from the top currently has 8 others with them. If they were to move up, they would move to the hole with 0 others. If they were to move down, they would move to the hole with 0 others. Since they like to be higher in the tree, they will move up to the top hole.

Each squirrel in the fourth hole from the top currently has 5 others with them. If they were to move up, they would move to the hole with 0 others. If they were to move down, they would move to the hole with 0 others. Since they like to be higher in the tree, they will move up to the hole above their present position.

The result of all the decisions is shown in the Day 2 diagram above.

- Day 2 to Day 3

Each squirrel in the top hole currently has 8 others with them. If they were to move down, they would move to the hole with 0 others. The choice is clear, they will move down one hole.

Each squirrel in the third hole from the top currently has 5 others with them. If they were to move up, they would move to the hole with 0 others. If they were to move down, they would move to the hole with 0 others. Since they like to be higher in the tree, they will move up to the hole above their present position.

The result of all the decisions is shown in the Day 3 diagram above.

All 15 squirrels are in the same hole the third day after the initial day.

