CIS 606 Homework 8 Fall 2019

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1. There are N ants on top of a fallen log (imagine the log as a very long line segment, and ants as points on the line). Each ant i is at the location a_i (a real number) feet from the leftmost of the log. You want to get rid of the ants by placing traps on the log. Each trap will lure ants that are 4-feet distance away. Give an efficient Greedy Algorithm that will get rid of all of the ants with minimal number of traps.

   The Ant-Trap(L, N) is proposed at the most efficient algorithm.

   A visual diagram of Ant-Trap(L, N) algorithm is shown in Figure.1.

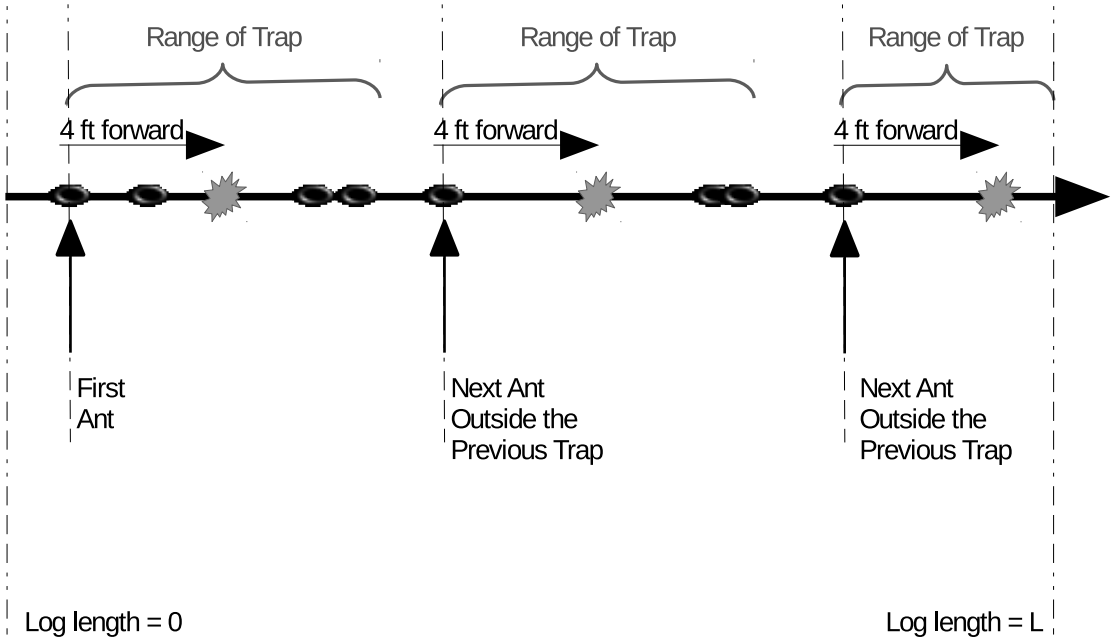

Figure 1: Ant-Trap(L, N) algorithm starting from left to right

This algorithm iterates from the leftmost side of the log and finds ants. Once the first ant is found it places the trap t_j, 4 feet forward. In this case all ants in the range of $[t_j - 4, t_j + 4]$ are all trapped in trap t_j.

To find the next trap, algorithm iterates to find the first ant outside of outside of trap t_j. Once found, it places the next trap t_{j+1} 4 feet forward. The algorithm keeps placing traps until all ants are trapped.

```
ANT-TRAP(L, N)
1  // set i = 1 to start from the leftmost ant on the log
2  i = 1
3  // set j = 1 to start with initializing the first trap
4  j = 1
5  while i ≤ N
6      if j == 1
7          // if j = 1 → it is the first trap to find → find the first ant and place trap 4 feed forward
8          t_j = a_i + 4
9      else
10         // if j ≠ 1 → this is not the first trap. To place the next trap, the first ant ouside
11         // the previous trap must be found first, and then next trap is placed 4 feed forward.
12         if a_i > t_j + 4
13             j = j + 1
14             t_j = min(a_i + 4, L)
15     // iterate to next ant
16     i = i + 1
```