

Q: *Cutting a Stick*

A stick n inches long needs to be cut into n 1-inch pieces. Outline an algorithm that performs this task with the minimum number of cuts if several pieces of the stick can be cut at the same time. Also give a formula for the minimum number of cuts.

A:

ALGORITHM:

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//Input:  $n$  inches of a stick
//Output: minimum number of cuts to  $n$  1-inch pieces
 $n$            // the length of the longest stick
 $cuts \leftarrow 0$  // the number cuts done
while  $n > 1$ 
    if  $n$  is odd
         $n \leftarrow (n + 1) / 2$  // cut off  $(n + 1) / 2$  inches from sticks with length longer than  $max$  at the same
                               // time
    else
         $n \leftarrow n / 2$  // cut off  $n / 2$  inches from sticks with length longer than  $max$  at the same time

     $cuts \leftarrow cuts + 1$  // count the number of cuts
return  $cuts$ 
```

FORMULA: Minimum number of cuts

$$cuts = \begin{cases} \log_2 n + 1 & \text{if } n \text{ is odd} \\ \log_2 n & \text{if } n \text{ is even} \end{cases}$$