You are given a histogram in the form of a list $H$ of natural numbers. Write a program to find the longest segment of $H$ in which the height (each item) is at least as large as the segment length.

Here is a sketch of the solution. The specifications are informal, the proofs are missing, and the timing is missing.

I will check all segments $m..n$ from longest ($\#H$) to shortest (0), and at each length from left to right, stopping the first time I find a square. For each length $n-m$, there are $\#H - (n-m) + 1$ segments to check. For each segment, we can discard it when we find the first height ($H_i$) that's too short (< segment length $n-m$). A longest segment will be found; the empty segment if nothing longer. So there's no need to check whether we have run out of segments.

$$S = (m',..n' \text{ is the base of the largest square})$$
$$R = (m..n \text{ is the next segment to be checked})$$
$$Q = (m \leq i \leq n \text{ and } m..i \text{ is fine and } i..n \text{ needs to be checked})$$

$$S \Leftarrow m:=0. \ n:=\#H. \ R$$
$$R \Leftarrow i:=m. \ Q$$

$$Q \Leftarrow \text{if } i=n \text{ then ok}$$
$$\quad \text{else if } H_i \geq n-m \text{ then } i:=i+1. \ Q$$
$$\quad \text{else if } n<\#H \text{ then } m:=m+1. \ n:=n+1 \text{ else } n:=\#H-m-1. \ m:=0 \text{ fi.}$$
$$R \text{ fi fi}$$