

- 231 (longest plateau) You are given a nonempty sorted list of numbers. A plateau is a segment (sublist of consecutive items) of equal items. Write a program to find
- (a) the length of a longest plateau.
 - (b) the number of longest plateaus.

After trying the question, scroll down to the solution.

(a) the length of a longest plateau.

§ Let the list be L . Let $P i j$ mean that $L[i..j]$ is a plateau in $L[0..k]$. Formally,

$$P = \langle i, j \rightarrow 0 \leq i \leq j \leq k \leq \#L \wedge \forall l: i..j \cdot L i = L l \rangle$$

Let Q say that $p =$ (the length of a longest plateau in $L[0..k]$). Formally,

$$Q = (\exists i, j \cdot P i j \wedge p = j - i) \wedge (\forall i, j \cdot P i j \Rightarrow p \geq j - i)$$

The desired result is that $p' =$ (the length of a longest plateau in L). Let

$$R = Q' \wedge k = \#L$$

Then R implies the desired result. Now we can refine.

$$R \Leftarrow p := 1. k := 1. Q \Rightarrow R$$

$$Q \Rightarrow R \Leftarrow \text{if } k = \#L \text{ then ok else } Q \wedge k < \#L \Rightarrow R \text{ fi}$$

$$Q \wedge k < \#L \Rightarrow R \Leftarrow \text{if } L(k-p) = L k \text{ then } Q \wedge k < \#L \wedge L(k-p) = L k \Rightarrow R \\ \text{else } Q \wedge k < \#L \wedge L(k-p) \neq L k \Rightarrow R \text{ fi}$$

$$Q \wedge k < \#L \wedge L(k-p) = L k \Rightarrow R \Leftarrow p := p + 1. k := k + 1. Q \Rightarrow R$$

$$Q \wedge k < \#L \wedge L(k-p) \neq L k \Rightarrow R \Leftarrow k := k + 1. Q \Rightarrow R$$

We are finished, but we can do better. We re-refine one specification.

$$Q \wedge k < \#L \wedge L(k-p) = L k \Rightarrow R \Leftarrow p := p + 1. k := k + 1. Q \wedge L(k-p) = L(k-1) \Rightarrow R$$

$$Q \wedge L(k-p) = L(k-1) \Rightarrow R \Leftarrow$$

$$\text{if } k = \#L \text{ then ok else } Q \wedge k < \#L \wedge L(k-p) = L(k-1) \Rightarrow R \text{ fi}$$

$$Q \wedge k < \#L \wedge L(k-p) = L(k-1) \Rightarrow R \Leftarrow$$

$$\text{if } L(k-p) = L k \text{ then } Q \wedge k < \#L \wedge L(k-p) = L k \Rightarrow R$$

$$\text{else } Q \wedge k < \#L \wedge L(k-p) = L(k-1) \neq L k \Rightarrow R \text{ fi}$$

$$Q \wedge k < \#L \wedge L(k-p) = L(k-1) \neq L k \Rightarrow R \Leftarrow$$

$$\text{if } k + p \geq \#L \text{ then ok}$$

$$\text{else } k := k + p. Q \wedge k < \#L \Rightarrow R \text{ fi}$$

We can step ahead p places because in a sorted list, there cannot be two separate plateaus of the same item.

(b) the number of longest plateaus.

no solution given