Special Peak

Inputs: A signal of unknown origin sampled at a rate of 10Hz and stored in the file `Signal.csv`. You are also given the expected mean of this signal, stored as a single value in `ExpectedMean.csv`.

Description: You are asked to implement a process which takes the input signal and finds the signal's "special" peak from a set of "valid" peaks. Here is how to find valid peaks:

1) Find the largest undesignated peak in the signal (this will simply be the largest peak to start with). This peak is designated as valid and has amplitude A_n.
2) Remove from consideration all peaks within ±5s of the valid peak found in step 1 whose amplitude (peak height) is greater than $A_n/2$ (this includes peaks exactly ±5s from the valid peak)
3) Repeat steps 1 and 2 until all peaks have either been designated as valid or removed

The special peak is the valid peak with the smallest amplitude.

The signal provided contains the true signal of interest and an additive output bias whose value starts at 0 and accumulates linearly at a constant but unknown rate. This means that the given signal $y(t)$ can be written as the summation of the true signal $s(t)$ and a linearly increasing bias:

$$y(t) = s(t) + at$$

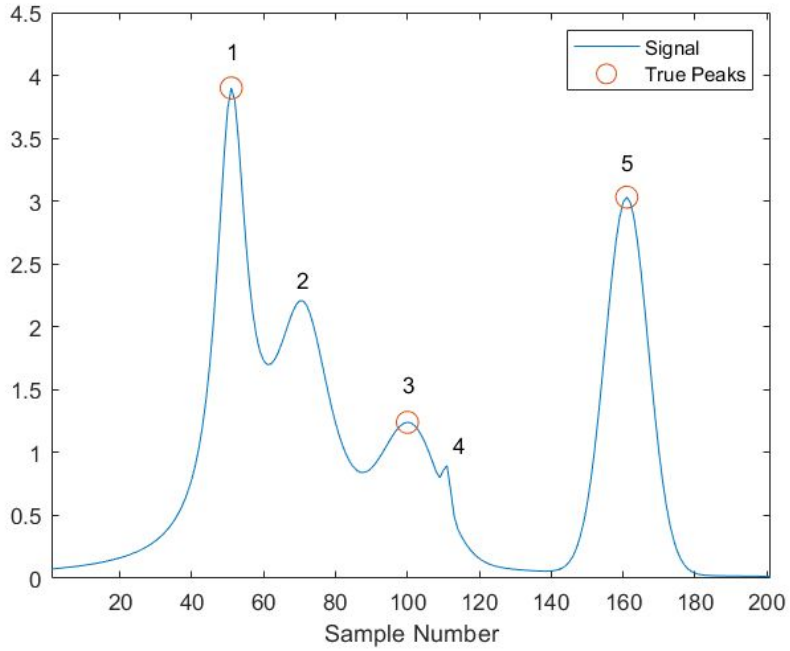
where a is the unknown bias accumulation rate. The special peak can therefore only be found by first removing the bias from the given signal to recover the true signal, and then applying the procedure described above.

Output: A single value containing the **1-based** sample index at which the special peak occurs. If more than one peak meets the special peak criteria, return the one which is closest to the beginning of the signal.

Instructions: Write code in any language of your choice which produces the required output from the given input. You may use any built-in language or library features and functions **EXCEPT** for any peak finding functions. For example, you may not use `findpeaks` in Matlab or `signal.find_peaks` from the Python SciPy library. Within 48 hours of receiving this problem, please return your answer in the text of an email and attach a copy of your code.

Example

Consider the following signal, which has already had the output bias removed:



- Peak 1 is the largest peak and is therefore valid.
- Peak 2 lies within 5s of peak 1 and $A_2 > A_1/2$, so peak 2 is duly removed from consideration.
- The next-largest peak for consideration is therefore peak 5, so peak 5 is valid.
- No peaks meet peak 5's removal criteria.
- The next peak is therefore peak 3, which is valid.
- Peak 4 meets peak 3's removal criteria, so is removed
- There are no more peaks for consideration and this signal contains a total of 3 valid peaks.

Of the 3 valid peaks in the signal, peak 3 has the lowest amplitude. Peak 3 is therefore the signal's "special peak". Peak 3 occurs at sample 100, so the returned value would be 100.