

Problem 217: Incoming!

Difficulty: Hard

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Problem Background

Some applications are interested in finding the longest subarray of contiguous elements that contain the largest sum. For example, if the elements of the array contain the number of rich metal resources in a mining deposit, a mining company would like to focus on the group of contiguous elements with the largest sum of these rich metal resources.

Problem Description

You are located on a top-secret military base. You have received intelligence that an enemy force has launched multiple waves of attack drones, targeting your base. But the enemy does not know that the base has defense technology capable of detecting and destroying the drones. The detection system can not only detect the drones, but also calculate a threat level for each drone. Threat levels are determined based on the offensive and defensive capabilities of each drone. For example, some drones may have machine guns, while others have rocket launchers. The threat level for each drone ranges from 0 to 30, where 0 is a non-threat and 30 is the highest threat. The detection system has determined that each wave of drones have been launched in a contiguous horizontal straight-line formation, meaning that each drone is adjacent to one or two other drones.

The defense system is prepared to engage the drones, but the system is only capable of destroying up to 15 contiguous drones per shot. The program for the defense system currently has no way of determining which 15 drones to shoot first. But the command team has hired you to optimize the program by calculating the largest contiguous subarray within the wave which adds up to the highest sum. That is the largest subarray which has the highest total threat value, up to 15 drones. Once this subarray is found, the defense system will destroy the drones within the subarray, then the detection system will update the array of drones with the previous subarray removed. On the next shot the system will again detect and destroy the largest subarray with the highest threat total, and so on, until all drones within the wave are destroyed. This will be repeated for each incoming wave of drones.

There are two special cases which may arise that the command team has provided instructions for:

- **Special Case 1:** A group of less than 15 contiguous drones that have a higher threat value than any group of 15 drones.
 - This occurs when the highest threat subarray of drones has zero threat level drones on both the left and right side.
 - For example, if given this array of 16 drones: 0 8 16 11 25 4 17 13 14 17 24 5 0 22 29 0

- The highest threat level subarray would be: 8 16 11 25 4 17 13 14 17 24 5 0 22 29, because the 0 values at the ends do not add any value to the total threat. But even though they are a non-threat, we still want to shoot them down.
- This subarray only has 14 drones. We want to shoot down 15. So, which zero should we add to the subarray? Here is how you decide:
 - If there are additional elements remaining on the left side of the subarray, append those values to the shot, until you reach 15 drones.
 - If there are no elements remaining on the left of the subarray, append elements on the right side of the subarray to the shot, until you reach 15 drones.
 - If there are no remaining elements to append on the left and right side, then you can shoot down less than 15 drones. This should only occur on the final shot.
- This process may increase the total threat value if there are more zeros on the right of the subarray, than on the left, or vice versa.
- **Special Case 2:** Two or more groups of 15 contiguous drones that have the same threat value.
 - This case should be considered after special case #1 has been accounted for.
 - If there are multiple subarrays of 15 drones that have equal total threat value and have the highest total threat value, we will shoot down the group of drones furthest from the left side of the wave.

Sample Input

The first line of your program's input, received from the standard input channel, will contain an integer representing the number of test cases. Each test case will contain:

- A line containing a positive integer **N**, representing the size of the wave.
- A line containing **N** integers separated by spaces, representing the threat levels of each drone in the wave

```
2
28
0 15 1 1 21 1 19 8 11 29 5 24 23 15 29 12 0 7 12 18 16 1 29 12 22 25 17 0
30
22 16 17 24 22 27 18 20 15 28 13 18 24 8 5 11 17 3 28 2 27 26 12 7 5 4 28 10 0 26
```

Sample Output

For each test case there will be a variable number of shots taken. For each shot, there will be eight output lines with descriptive labels; see the sample output provided below for those labels. The eight lines will contain the following data, in order:

- The wave number (**X**) and shot number (**Y**), in the format "Wave #**X** --- Shot #**Y**"

- The current elements in the wave, in the order originally presented in the input, but omitting any drones that have already been shot down
- The current size of the wave (the number of elements just printed on the previous line).
- The total threat value of the wave.
- The zero-based indices of the first and last elements to be targeted by the current shot.
- The elements that are being targeted, in the order originally presented in the input.
- The number of elements in the targeted range.
- The total threat value of the targeted range.

Include an additional blank line after each shot's report.

Due to the length of the sample output, it is provided on the next page to avoid breaking across pages. Note that some output may break across multiple lines due to its length; please download and consult the provided sample output file to view the output accurately.

Wave #1 --- Shot #1

Elements in wave: 0 15 1 1 21 1 19 8 11 29 5 24 23 15 29 12 0 7 12 18 16 1 29 12
22 25 17 0

Current size of wave: 28

Total threat value of wave: 373

Targeted range: Elements 11 to 25

Eliminated elements: 24 23 15 29 12 0 7 12 18 16 1 29 12 22 25

Number of elements destroyed: 15

Total threat value eliminated: 245

Wave #1 --- Shot #2

Elements in wave: 0 15 1 1 21 1 19 8 11 29 5 17 0

Current size of wave: 13

Total threat value of wave: 128

Targeted range: Elements 0 to 12

Eliminated elements: 0 15 1 1 21 1 19 8 11 29 5 17 0

Number of elements destroyed: 13

Total threat value eliminated: 128

Wave #2 --- Shot #1

Elements in wave: 22 16 17 24 22 27 18 20 15 28 13 18 24 8 5 11 17 3 28 2 27 26
12 7 5 4 28 10 0 26

Current size of wave: 30

Total threat value of wave: 483

Targeted range: Elements 0 to 14

Eliminated elements: 22 16 17 24 22 27 18 20 15 28 13 18 24 8 5

Number of elements destroyed: 15

Total threat value eliminated: 277

Wave #2 --- Shot #2

Elements in wave: 11 17 3 28 2 27 26 12 7 5 4 28 10 0 26

Current size of wave: 15

Total threat value of wave: 206

Targeted range: Elements 0 to 14

Eliminated elements: 11 17 3 28 2 27 26 12 7 5 4 28 10 0 26

Number of elements destroyed: 15

Total threat value eliminated: 206