

## Problem 153: Dive Time

Difficulty: Hard

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### Problem Background

SCUBA diving can be an amazing experience, but divers have to overcome one major obstacle: breathing. Divers typically breathe from a tank of compressed air using specialized equipment that allows them to breathe almost normally. However, the body is subject to very high pressures when underwater, which can cause some difficulties of its own.

Most of the air we breathe is comprised of nitrogen, which our bodies largely ignore. However, when in a high-pressure environment (such as when someone is diving), the nitrogen is forcibly dissolved into our blood. As a diver returns to normal pressure, the nitrogen precipitates, or begins to return to a gaseous form. As long as this return is done gradually, the nitrogen leaves via the lungs, gets breathed out, and there aren't any problems.

However, if a diver ascends too quickly, the nitrogen remains in the bloodstream as it precipitates, forming small bubbles. This causes an extremely painful and potentially fatal condition called decompression sickness, more commonly known as the "bends" for how it causes victims to double up in pain. To avoid this condition, divers must ascend very slowly, and in many cases must wait at certain depths for a period of time to allow the nitrogen enough time to leave the bloodstream. These "decompression stops" are determined using a complex series of calculations... which, in case you were wondering, is finally where software engineering gets involved.

Divers can make use of computers that measure how long a diver remains at a particular depth, and automatically determine at what depths a diver has to make a decompression stop, and for how long. Since performing these decompression stops accurately can mean the difference between life and death, it's critical that these computers perform accurate calculations.

### Problem Description

Lockheed Martin has been contracted by the United States Navy to develop a new system to calculate required decompression stops for SCUBA divers. The US Navy maintains a set of commonly-used dive tables which outline the required decompression stops for dives of various durations and depths. Your program will need to use the information in these tables, which will be provided to your program, to determine the appropriate decompression schedule.

Dive tables can vary widely, depending on a wide range of factors. Your program will be provided with dive table information appropriate to the circumstances of the dive being undertaken.

To use a dive table, a diver must determine the maximum depth they reached, then find the entries in the table that show a depth equal to or greater than that depth. Then, they must calculate their “bottom time;” the amount of time spent between entering the water and starting their ascent. They must find any entries in the table that pertain to the next time greater than or equal to their bottom time. These entries will indicate how long they need to stop for decompression, and at what depth(s).

For example, consider a diver that reached a depth of 115 feet and started returning to the surface after spending 38 minutes underwater. The table below shows an excerpt of the dive table they are using.

Max Depth (feet)	Stop Depth (feet)	Decompression Schedules for Bottom Times (minutes)								
110		20	25	30	35	40	45	50		
	20		5	14	27	39	50	71		
120		15	20	25	30	35	40	45		
	30						2	3		
	20		4	9	24	38	49	71		
130		12	15	20	25	30	35	40		
	30					2	5	6		
	20		3	8	17	32	44	66		

The diver exceeded a depth of 110 feet, so cannot use the information in that section of the table. They must use the next-deeper section, for dives up to 120 feet. The diver didn’t start ascending until after 38 minutes, so they must use the schedule for the first time greater than or equal to that amount; in this case, the 40-minute schedule. That schedule indicates they must make two decompression stops; one for two minutes at 30 feet, and another for 49 minutes at 20 feet.

Your program must read in provided dive table information and data about individual dives to determine the appropriate decompression schedule to use for each dive. As shown above, some dives may require multiple decompression stops; in this case, you will receive multiple dive table entries for the same depth and bottom time. Some very short or very shallow dives may not require any decompression stops; these will be represented with dive table entries that indicate a decompression stop of 0 minutes is required at a depth of 0 feet.

*Safety Disclaimer: The information given here, and in any inputs provided to your program, is provided as a reference for solving this problem only. It has been simplified from the real US Navy dive tables, but, as a result, is incomplete. **DO NOT USE THIS INFORMATION FOR ACTUAL SCUBA DIVES**. Contact your diving certification authority, consult with your divemaster, and/or use a real dive computer (not one you wrote yourself!) to determine the appropriate decompression schedule for any SCUBA dives you make. As stated above, SCUBA diving is a dangerous sport that requires extensive training and adherence to strict safety protocols to avoid permanent bodily harm or death.*

## Sample Input

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

- A line containing two positive integers, separated by a space:
  - X, the number of entries in the dive table to be used for the test case
  - D, the number of dives conducted using that dive table
- X lines, each representing an entry in the dive table, and containing four integers separated by spaces, each representing:
  - The maximum depth (in feet) for this entry. This value will be positive.
  - The maximum bottom time (in feet) for this entry. This value will be positive.
  - The depth (in feet) at which a compression stop is required. This value will not be negative; a value of 0 indicates no compression stops are required.
  - The time (in minutes) at which a diver must stop at that depth for decompression. This value will not be negative; a value of 0 indicates no compression stops are required.
- D lines, each representing a dive performed using the given dive table, and containing two positive integers separated by spaces, each representing:
  - The maximum depth (in feet) reached by the diver. This value will not exceed the maximum depth defined by the dive table.
  - The diver's bottom time (in minutes). This value will not exceed the maximum bottom time for the given depth, as defined by the dive table.

```
1
5 3
20 600 0 0
30 371 0 0
30 380 20 5
120 40 30 2
120 40 20 49
28 375
16 240
117 38
```

## Sample Output

For each test case, your program must output information about the decompression stops the divers must make during their ascents, if any, in order to avoid decompression sickness.

For each stop a diver is required to make in each dive, your program must print one line containing two integers separated by spaces, each representing:

- The depth (in feet) at which a decompression stop should be made
- The amount of time (in minutes) at which the diver should remain at that depth

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When multiple decompression stops are required, they must be printed in order of decreasing depth. If a dive does not require any decompression stops, your program should print the words "No Stop".

20 5

No Stop

30 2

20 49