6788 Gridstown Trip Planner

The city of Gridstown is built on a 10 km by 10 km square axis-aligned grid with a 100 m grid-line spacing. Footpaths run along all grid lines. All addresses in Gridstown are given by non-negative integer x, y coordinates in the 100 m grid. The residents of Gridstown move around the city by a combination of walking on the footpaths and taking public transport. All residents walk at a rate of 100 m/minute.

Public transport consists of three train services: one perimeter service and two diagonal services. On all three services a train leaves from the starting point every hour, on the hour, 24 hours a day, seven days a week. The perimeter service runs anticlockwise around the perimeter of the city starting from the southwest corner of the city, (0, 0). One diagonal service starts from the southwest corner, (0, 0), and goes to the northeast corner and back. The other starts from the southeast corner and goes to the northwest corner and back. All trains stop on every 1 km grid point and take 2 minutes between stops. When they have returned to their starting point, their run is complete.

For example the perimeter service leaving from (0, 0) at 10:00 arrives at (10, 0) at 10:02, at (20, 0) at 10:04 and eventually returns to (0, 0) after 80 minutes. The time difference between a train's arrival at a station and its departure can be neglected but if two trains arrive at a station at the same time a transfer from one train to another is possible.

You have been asked by the city fathers to write a trip planner for Gridstown residents, which works out the latest time that one can leave a given start point and arrive at a given destination point at or before a specified time.

A route can involve at most a single train-ride section. Two or more consecutive trainrides, with no walks between them, are counted as a single section of the route.

The only information to be printed is the departure time.

Input

The first line of the input contains an integer m specifying the number of route queries. Each of the following m line contains four integers $0 \leq x_1, y_1, x_2, y_2 \leq 100$ followed by the arrival time t_{dest}. Single spaces separate all entries. Time is given in 24 hour format with a 1 or 2 digit hour from 0 to 23, a colon and then a 2 digit number of minutes from 00 to 59.

Output

For each route query the output consists of the latest possible departure time from (x_1, y_1) that allows a traveller to arrive at (x_2, y_2) on or before time t_{dest} within a 24 hour window.

Explanation:

In the first example, the quickest route is to walk on the grid from (33, 34) to (35, 35), a distance of 300 m, which takes 3 minutes. So the departure time is 2 minutes before midnight.

In the second case the best option is to leave from (23, 20) at 10:01, walk for 3 minutes to (20, 20) in time to catch the first diagonal train to (50, 50) arriving at 10:10. Then catch the other diagonal train departing from (50, 50) at 10:10 and get off at (20, 80) at time 10:16. Walk 5 minutes to (25, 80), arriving at 10:21. Variants where one walks further, having alighted from the second train at an earlier or later stop, are also possible but only the departure time is required, which is the same for all such variants.

Sample Input

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2
33 34 35 35 0:01
23 20 25 80 11:00
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Sample Output

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23:58
10:01
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