

2nd International Olympiad in Informatics

MINSK, 1990

Round 2.

PROBLEM 1.

Each watchman in a certain art gallery is on duty during some continuous time period. The Guard Schedule is defined to be a set of pairs $[T1(i), T2(i)]$ - the starting and the ending times of the i 'th watchman's duty. Given a Guard Schedule you are required:

- (a) To check whether there are at least two watchman in the gallery at each moment of the period $[0, EndTime]$. If the condition (a) is not fulfilled,
- (b) Determine all the periods when the guard is insufficient (less than two watchmen on duty).
- (c) Find the minimal number of additional watchmen with duties of a prescribed equal length needed to obtain a valid Guard Schedule, i.e. one with condition (a) fulfilled.

INPUT:

(All times are given in integer minutes.)

EndTime - the time when the guard is over, i.e. the gallery should be guarded within the period $[0, EndTime]$.

N - the number of watchmen. $T1[i], T2[i], i=1, \dots, N$ - the starting and the ending times of the i 'th watchman's duty.

Length - the prescribed length of the duty for each additional watchman.

OUTPUT:

(1) The answer for point (a) in the form "Yes/No".

(2) If the previous answer is "no", the list of pairs $(k, 1)$ - the beginnings and the ends of all time periods with insufficient guard, and the number of watchmen in each (0 or 1).

(3) The number of additional watchmen and the list of starting and ending times of every additional watchman's duty.