BRONZE PROBLEMS

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Four problems numbered 11 through 14

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Problem 11: Time Cards [Rob Kolstad, 2009]

Farmer John wanted to improve farm productivity, so his cows now

get extra hay if they spend more time at a milking machine. To

implement this plan, he has instituted the use of time cards for

each of the N (1 <= N <= 145) cows conveniently numbered 1..N. When

a cow starts at a milking machine, she enters the start time on the

master time card. Likewise, when she leaves, she notes that on the

master time card, as well. FJ is fortunate to have enough milking

machines that he can milk every cow at the same time.

The time entries are typed into a computer file where each line

includes a cow number C (1 <= C <= N), a keyword ('START' or 'STOP'),

and the time expressed as two space-separated integers HH and MM

(0 <= HH <= 23; 0 <= MM <= 59). Cows never stay at the machine past

midnight. The timecard file is complete in the sense that every

cow's START entry contains a corresponding STOP entry later in the

input file.

Calculate the total time each cow spends at the milking machine.

By way of example, consider a time card file for just two cows. The

file includes not only the number of cows but also the total number

of time card entries, Nlines (1 <= Nlines <= 1,458).

2 6

1 START 9 0

2 START 9 30

1 STOP 10 0

2 STOP 10 15

1 START 17 0

1 STOP 17 42

Cow 1 spent times 9:00-10:00 and 17:00-17:42 at the machine for a

total of one hour and 42 minutes (1:42). Cow 2 spent time 9:30-10:15

at the machine, for a total of 45 minutes.

PROBLEM NAME: timecards

INPUT FORMAT:

\* Line 1: Two space-separated integers: N and Nlines

\* Lines 2..Nlines+1: Each line contains four space-separated entities:

C, keyword, HH, and MM

SAMPLE INPUT (file timecards.in):

2 6

1 START 9 0

2 START 9 30

1 STOP 10 0

2 STOP 10 15

1 START 17 0

1 STOP 17 42

OUTPUT FORMAT:

\* Lines 1..N: Line i contains two space-separated integers that are

respectively the number of hours and minutes that cow i spends

at the milking machine. Of course, the minutes value never

exceeds 59.

SAMPLE OUTPUT (file timecards.out):

1 42

0 45

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Problem 12: O Those Fads [Jarrah Lacko, 2009]

Like any other teenager, teen cows are occasionally overtaken by

fads. Sometimes it's a hula hoop or a pet rock, other times it's

Counterstrike, Pokemon, Rick Astley, or tribal tattoos on their

udders.

Mathematically, we know that a fad has an initial attractiveness

level L (1 <= L <= 50,000). Cow i has a resistance (0 <= R\_i <=

1,000,000) that tells how long she can avoid a fad before having

no alternative but to participate. When a fad's attractiveness level

meets or exceeds a cow's fad resistance, then the cow will want to

participate in the fad.

Each cow who participates in a fad increases (through peer pressure)

that fad's attractiveness by some value K (1 <= K <= 2,500).

Given a population of N (1 <= N <= 100,000) cows, determine how

many will participate in a fad.

PROBLEM NAME: fads

INPUT FORMAT:

\* Line 1: Three space-separated integers: N, L, and K

\* Lines 2..N+1: Line i+1 contains cow i's a single integer that is fad

resistance: R\_i

SAMPLE INPUT (file fads.in):

5 2 3

2

6

12

5

14

INPUT DETAILS:

Five cows with fad resistances 2, 6, 12, 5, and 14. Initial fad

attractiveness is 2; peer pressure adds 3 for each attractiveness

index for each cow that participates.

OUTPUT FORMAT:

\* Line 1: A single integer that is the number of cows how ultimately

participate in the fad.

SAMPLE OUTPUT (file fads.out):

3

OUTPUT DETAILS:

The initial attraction level of 2 brings in cow #1 (whose resistance

is 2) and raises the attractiveness level to 5, thus attracting cow

#4 (whose resistance is 5) and raising the attractiveness level to

8. This attracts cow #2 (resistance: 6) and raises the attractiveness

level to 11. Neither cow #3 (resistance: 12) or cow #5 (resistance:

14) is sucked into the fad; a total of 3 cows particpate.

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Problem 13: Good Grass [Rob Kolstad, 2009]

Bessie believes that her favorite pasture has a patch of very special

grass that is the best grass on earth. She thinks it helps cows

produce more milk.

Each of the cows has returned to her assigned grazing spot, which

is at some point in a fully populated rectilinear grid. Consider

the example on the left below where the number of rows, NR (3 <=

NR <= 100) is 6 and the number of columns, NC (3 <= NC <= 100) is

5. The spots for cows are marked with a 'C'.

Bessie actually knows the milk production P\_rc (1 <= P\_rc <= 100)

of each of the cows in the grid; the cows are tagged with the

production number in the grid on the right, below.

COLUMN COLUMN

1 2 3 4 5 1 2 3 4 5

+-------------- +--------------

1| C C C C C 1| 5 6 7 4 6

R 2| C C C C C R 2| 7 7 8 6 5

O 3| C C C C C O 3| 9 9 8 3 5

W 4| C C C C C W 4| 8 8 7 6 4

5| C C C C C 5| 4 5 2 4 5

6| C C C C C 6| 3 4 2 3 4

Bessie wants to find the location of the special grass. She intends

to do this by finding the 3 x 3 grid of cows whose total milk

production is the largest.

Find the 3 x 3 grid whose nine components sum to the greatest number

and report the value of its upper left corner (first the row, then

the column). In the grid above on the right, the largest sum is 71

found in the grid whose upper left corner (as depicted) is row 2,

column 1.

If two 3 x 3 grids have the same sum, output the one whose row

number is smallest. If more than one grid on that row has the same

sum, output the one with the lowest column number.

PROBLEM NAME: goodgrs

INPUT FORMAT:

\* Line 1: Two space-separated integers: NR and NC

\* Lines 2..NR+1: Line r+1 contains NC space-separated integers that

represent row r of the pasture's grid.

SAMPLE INPUT (file goodgrs.in):

6 5

5 6 7 4 6

7 7 8 6 5

9 9 8 3 5

8 8 7 6 4

4 5 2 4 5

3 4 2 3 4

OUTPUT FORMAT:

\* Line 1: A single integer that is the greatest possible sum in a 3 x

3 square.

\* Line 2: Two space-separated integers that are respectively the row

and column of the upper left corner of the 'best' 3 x 3 square

grid.

SAMPLE OUTPUT (file goodgrs.out):

71

2 1

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Problem 14: Treasure Cave [Rob Kolstad, 2009]

Bessie's grandfather was a pirate who accumulated a great treasure

chest of golden plunder. He hid the treasure chest in a cave that

Bessie has recently discovered right on Farmer John's land! Just

inside the cave's entrance she found a map that told her how to get

the treasure.

The cave has P passages (3 <= P <= 5,000) conveniently numbered

1..P. The entrance is passage 1; the treasure is located in some

reachable passage T (2 <= T <= P), whose value is supplied. Passages

are all approximately the same length; each one leads to a split

where hitherto unexplored numbered passages take the inquisitive

cow deeper underground. No passage appears as the split from more

than one passage, and the map contains a total of NS splits (1 <=

NS <= 5,000).

Bessie wants to know both how far away from the entrance the treasure

lies and also which passage numbers to take to get to the treasure.

Consider the schematic representation of a cave shown below. Passage

numbers are shown close to the passage they name. For this example,

the treasure is at the end of passage number 7:

3/

/

+

/ \ /5

2/ 4\ /

1 / +

----+ 6\ #7 /11

\ \ / /

13\ + +

8\ 10/ \

\ / \12

+

9\

\

Bessie would have to traverse passages 1, 2, 4, 6, and 7 to get to

the treasure, a total distance of 5 (which is simply the passage

count).

The input file includes a set of lines, each with a passage number

N (1 <= N <= P) and the two passages (B1 and B2; 1 <= B1 <= P; 1

<= B2 <= P) that branch off from it. Some line in the input file

will include passage number 1 and its two branches (for our example,

passages 2 and 13; likewise, passage number 8 has two branches: 9

and 10).

Tell Bessie how to get to the treasure.

PROBLEM NAME: tcave

INPUT FORMAT:

\* Line 1: Line 1 contains three space-separated integers: P, NS, and T

\* Lines 2..NS+1: Each line contains three space-separated integers: N,

B1, and B2

SAMPLE INPUT (file tcave.in):

13 6 7

6 7 8

2 3 4

10 11 12

8 9 10

1 2 13

4 5 6

INPUT DETAILS:

This input describes the sample cave in text.

OUTPUT FORMAT:

\* Line 1: The distance D from the entrance to the treasure

\* Lines 2..D+1: Line i+1 contains a single integer that is next

passage Bessie takes to get to the treasure.

SAMPLE OUTPUT (file tcave.out):

5

1

2

4

6

7

OUTPUT DETAILS:

As in the text.

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