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The Virtual Learning Environment for Computer Programming

List of activities X71187_en

At the end of the problem statement you will find a half-implemented program which you have to finish. In particular, two functions in the program are incomplete. The following text explains the data with which the functions work and what they do.

The program works with a data type `Activity`, which represents an activity, including a name, the starting time (t1), and the ending time (t2). To simplify, t1 and t2 are integer variables, and the program always works with activites with correct times, t1<t2:

```
struct Activity {
  string name;
  int t1,t2;
};
```

The program also works with a data type `ListActivities`, which is a list of activities:

```
typedef vector<Activity> ListActivities;
```

The first function you will have to implement verifies that two activities are compatible, that is, they do not overlap in time. In the particular case that one activity ends exactly at the time when another starts, they will be considered compatible.

```
bool compatibleActivities(Activity a, Activity b)
```

The second function you have to implement receives two activities and returns true if the first is less than the second, according to the following criteria. An activity is less than another if it starts strictly before the other, or it starts at the same time and ends strictly before, or has the same start time and end time as the other but its name is less than the name of the other in lexicographical order.

```
bool smallerActivity(Activity a, Activity b)
```

The previous function is used from another point in the program to sort all activities.
Finish the following code to solve the problem:

```
#include <iostream>
#include <string>
#include <vector>
#include <algorithm>

// Here you can add more includes if you wish.

using namespace std;

struct Activity {
  string name;
  int t1, t2; // t1<t2 must be satisfied for a correct activity
};
```

```cpp
typedef vector<Activity> ListActivities;

// Auxiliary functions (you can add more functions if you wish)

// Pre:  The input contains a description of an activity with the format:
//
//       name t1 t2
//
//       where name is a non-empty string with lowercase letters and t1<t2
// Post: Returns the activity read from the input adapted to the format of stru
Activity readActivity()
{
  Activity a;
  cin >> a.name >> a.t1 >> a.t2;
  return a;
}

// Pre:  listactivities represents a list of correct activities
// Post: Prints all activities from first to last, one per line, and with the fo
//
//       name t1 t2
void printActivities(const ListActivities &listactivities)
{
  for (int i = 0; i < int(listactivities.size()); i++) {
    const Activity &a = listactivities[i];
    cout << a.name << " " << a.t1 << " " << a.t2 << endl;
  }
}

// Pre:  a, b represent correct activities.
// Post: Returns true iff the activities have a compatible timeline,
//       i.e. they do not overlap in time.
//       Note: if one of them finishes exactly when the other starts, then they
bool compatibleActivities(Activity a, Activity b)
{
  // Implement this function.
  // ...
}

// Pre:  a, b represent correct activities.
// Post: Returns true iff one of the following conditions holds:
//         - a starts strictly before b.
//         - a and b start at the same time but a finishes before b.
//         - a and b coincide in start and end time, but a has lexicographicall
bool smallerActivity(Activity a, Activity b)
{
  // Implement this function.
  // ...
```

```
}

int main()
{
  ListActivities listactivities;
  string command;
  while (cin >> command) {
    if (command == "NEW") {
      listactivities.push_back(readActivity());
    } else if (command == "SORT") {
      sort(listactivities.begin(), listactivities.end(), smallerActivity);
    } else if (command == "PRINT") {
      cout << "Current list activities:" << endl;
      printActivities(listactivities);
      cout << endl;
    } else if (command == "CHECKCOMPATIBLE") {
      int i, j;
      cin >> i >> j;
      string namei = listactivities[i].name;
      string namej = listactivities[j].name;
      if (compatibleActivities(listactivities[i], listactivities[j]))
        cout << "Activities " << namei << " and " << namej << " are compatible"
      else
        cout << "Activities " << namei << " and " << namej << " are incompatibl
      cout << endl;
    }
  }
}
```

Input

The input consists of a list of commands to create activities, sort them, write all of them, and check if two are compatible. There is no need to worry about the input since the main function already calls the appropriate functions to interpret the commands.

Output

The output shows the results of the commands. There is no need to worry about the output much since the main, which is given, already calls the appropriate functions to produce the output.

Sample input 1

```
NEW biking 169 277
PRINT
SORT
NEW cinema 224 598
SORT
PRINT
NEW jogging 108 483
PRINT
CHECKCOMPATIBLE 0 1
```

```
CHECKCOMPATIBLE 1 2
SORT
PRINT
NEW gym 24 184
NEW swimming 218 574
CHECKCOMPATIBLE 2 3
PRINT
SORT
NEW chatting 161 501
SORT
NEW climbing 26 510
```

```
PRINT
NEW reading 207 303
NEW siteseeing 440 561
PRINT
NEW strolling 318 385
PRINT
SORT
PRINT
CHECKCOMPATIBLE 1 7
NEW bowling 413 553
NEW boxing 42 253
PRINT
NEW writing 77 154
PRINT
SORT
NEW flirting 84 320
PRINT
NEW singing 281 548
CHECKCOMPATIBLE 6 7
PRINT
CHECKCOMPATIBLE 4 9
CHECKCOMPATIBLE 1 5
NEW dancing 398 498
CHECKCOMPATIBLE 7 8
NEW shopping 28 58
PRINT
CHECKCOMPATIBLE 3 5
CHECKCOMPATIBLE 0 13
SORT
NEW cooking 182 530
CHECKCOMPATIBLE 6 14
PRINT
NEW praying 54 433
SORT
NEW fishing 435 599
PRINT
CHECKCOMPATIBLE 9 14
SORT
CHECKCOMPATIBLE 0 7
PRINT
CHECKCOMPATIBLE 10 19
CHECKCOMPATIBLE 10 17
CHECKCOMPATIBLE 4 19
NEW hunting 380 465
PRINT
CHECKCOMPATIBLE 2 4
CHECKCOMPATIBLE 0 17
CHECKCOMPATIBLE 11 13
SORT
CHECKCOMPATIBLE 5 16
PRINT
CHECKCOMPATIBLE 1 14
CHECKCOMPATIBLE 7 14
CHECKCOMPATIBLE 7 14
CHECKCOMPATIBLE 1 13
CHECKCOMPATIBLE 4 12
CHECKCOMPATIBLE 9 12
CHECKCOMPATIBLE 5 8
CHECKCOMPATIBLE 8 15
CHECKCOMPATIBLE 5 7
CHECKCOMPATIBLE 5 11
```

```
CHECKCOMPATIBLE 9 10
CHECKCOMPATIBLE 17 18
CHECKCOMPATIBLE 1 9
CHECKCOMPATIBLE 3 18
CHECKCOMPATIBLE 5 16
CHECKCOMPATIBLE 4 17
CHECKCOMPATIBLE 10 16
CHECKCOMPATIBLE 8 17
CHECKCOMPATIBLE 1 3
CHECKCOMPATIBLE 17 20
CHECKCOMPATIBLE 1 12
CHECKCOMPATIBLE 8 10
CHECKCOMPATIBLE 0 3
CHECKCOMPATIBLE 4 11
CHECKCOMPATIBLE 4 11
CHECKCOMPATIBLE 12 19
CHECKCOMPATIBLE 0 16
CHECKCOMPATIBLE 4 11
CHECKCOMPATIBLE 9 11
```

Sample output 1

```
Current list activities:
biking 169 277

Current list activities:
biking 169 277
cinema 224 598

Current list activities:
biking 169 277
cinema 224 598
jogging 108 483

Activities biking and cinema are incompatible

Activities cinema and jogging are incompatible

Current list activities:
jogging 108 483
biking 169 277
cinema 224 598

Activities cinema and gym are compatible

Current list activities:
jogging 108 483
biking 169 277
cinema 224 598
gym 24 184
swimming 218 574

Current list activities:
gym 24 184
jogging 108 483
chatting 161 501
biking 169 277
swimming 218 574
cinema 224 598
climbing 26 510

Current list activities:
gym 24 184
jogging 108 483
chatting 161 501
biking 169 277
swimming 218 574
cinema 224 598
climbing 26 510
reading 207 303
siteseeing 440 561

Current list activities:
gym 24 184
jogging 108 483
chatting 161 501
biking 169 277
swimming 218 574
cinema 224 598
climbing 26 510
reading 207 303
```

```
siteseeing 440 561
strolling 318 385

Current list activities:
gym 24 184
climbing 26 510
jogging 108 483
chatting 161 501
biking 169 277
reading 207 303
swimming 218 574
cinema 224 598
strolling 318 385
siteseeing 440 561

Activities climbing and cinema are incompatible

Current list activities:
gym 24 184
climbing 26 510
jogging 108 483
chatting 161 501
biking 169 277
reading 207 303
swimming 218 574
cinema 224 598
strolling 318 385
siteseeing 440 561
bowling 413 553
boxing 42 253

Current list activities:
gym 24 184
climbing 26 510
jogging 108 483
chatting 161 501
biking 169 277
reading 207 303
swimming 218 574
cinema 224 598
strolling 318 385
siteseeing 440 561
bowling 413 553
boxing 42 253
writing 77 154

Current list activities:
gym 24 184
climbing 26 510
boxing 42 253
writing 77 154
jogging 108 483
chatting 161 501
biking 169 277
reading 207 303
swimming 218 574
cinema 224 598
strolling 318 385
bowling 413 553
siteseeing 440 561
flirting 84 320
```

Activities biking and reading are incompatible

Current list activities:
gym 24 184
climbing 26 510
boxing 42 253
writing 77 154
jogging 108 483
chatting 161 501
biking 169 277
reading 207 303
swimming 218 574
cinema 224 598
strolling 318 385
bowling 413 553
siteseeing 440 561
flirting 84 320
singing 281 548

Activities jogging and cinema are incompatible

Activities climbing and chatting are incompatible

Activities reading and swimming are incompatible

Current list activities:
gym 24 184
climbing 26 510
boxing 42 253
writing 77 154
jogging 108 483
chatting 161 501
biking 169 277
reading 207 303
swimming 218 574
cinema 224 598
strolling 318 385
bowling 413 553
siteseeing 440 561
flirting 84 320
singing 281 548
dancing 398 498
shopping 28 58

Activities writing and chatting are compatible

Activities gym and flirting are incompatible

Activities jogging and dancing are incompatible

Current list activities:
gym 24 184
climbing 26 510
shopping 28 58
boxing 42 253
writing 77 154
flirting 84 320
jogging 108 483
chatting 161 501
biking 169 277

reading 207 303
swimming 218 574
cinema 224 598
singing 281 548
strolling 318 385
dancing 398 498
bowling 413 553
siteseeing 440 561
cooking 182 530

Current list activities:
gym 24 184
climbing 26 510
shopping 28 58
boxing 42 253
praying 54 433
writing 77 154
flirting 84 320
jogging 108 483
chatting 161 501
biking 169 277
cooking 182 530
reading 207 303
swimming 218 574
cinema 224 598
singing 281 548
strolling 318 385
dancing 398 498
bowling 413 553
siteseeing 440 561
fishing 435 599

Activities biking and singing are compatible

Activities gym and jogging are incompatible

Current list activities:
gym 24 184
climbing 26 510
shopping 28 58
boxing 42 253
praying 54 433
writing 77 154
flirting 84 320
jogging 108 483
chatting 161 501
biking 169 277
cooking 182 530
reading 207 303
swimming 218 574
cinema 224 598
singing 281 548
strolling 318 385
dancing 398 498
bowling 413 553
fishing 435 599
siteseeing 440 561

Activities cooking and siteseeing are incompatible

Activities cooking and bowling are incompatible

Activities praying and siteseeing are compatible

Current list activities:
gym 24 184
climbing 26 510
shopping 28 58
boxing 42 253
praying 54 433
writing 77 154
flirting 84 320
jogging 108 483
chatting 161 501
biking 169 277
cooking 182 530
reading 207 303
swimming 218 574
cinema 224 598
singing 281 548
strolling 318 385
dancing 398 498
bowling 413 553
fishing 435 599
siteseeing 440 561
hunting 380 465

Activities shopping and praying are incompatible

Activities gym and bowling are compatible

Activities reading and cinema are incompatible

Activities writing and hunting are compatible

Current list activities:
gym 24 184
climbing 26 510
shopping 28 58
boxing 42 253
praying 54 433
writing 77 154
flirting 84 320
jogging 108 483
chatting 161 501
biking 169 277
cooking 182 530
reading 207 303
swimming 218 574
cinema 224 598
singing 281 548
strolling 318 385
hunting 380 465
dancing 398 498
bowling 413 553
fishing 435 599
siteseeing 440 561

Activities climbing and singing are incompatible

Activities jogging and singing are incompatible

Activities jogging and singing are incompatible

Activities climbing and cinema are incompatible

Activities praying and swimming are incompatible

Activities biking and swimming are incompatible

Activities writing and chatting are compatible

Activities chatting and strolling are incompatible

Activities writing and jogging are incompatible

Activities writing and reading are compatible

Activities biking and cooking are incompatible

Activities dancing and bowling are incompatible

Activities climbing and biking are incompatible

Activities boxing and bowling are compatible

Activities writing and hunting are compatible

Activities praying and dancing are incompatible

Activities cooking and hunting are incompatible

Activities chatting and dancing are incompatible

Activities climbing and boxing are incompatible

Activities dancing and siteseeing are incompatible

Activities climbing and swimming are incompatible

Activities chatting and cooking are incompatible

Activities gym and boxing are incompatible

Activities praying and reading are incompatible

Activities praying and reading are incompatible

Activities swimming and fishing are incompatible

Activities gym and hunting are compatible

Activities praying and reading are incompatible

Activities biking and reading are incompatible

Sample input 2

```
NEW biking 1 3
PRINT
NEW cinema 2 3
CHECKCOMPATIBLE 0 1
PRINT
NEW jogging 0 3
NEW gym 1 3
PRINT
NEW swimming 2 3
PRINT
CHECKCOMPATIBLE 2 3
CHECKCOMPATIBLE 3 4
CHECKCOMPATIBLE 1 4
CHECKCOMPATIBLE 1 3
NEW chatting 0 1
CHECKCOMPATIBLE 0 2
NEW climbing 1 2
NEW reading 0 1
NEW siteseeing 1 2
PRINT
NEW strolling 0 1
CHECKCOMPATIBLE 2 7
CHECKCOMPATIBLE 3 6
CHECKCOMPATIBLE 0 7
PRINT
CHECKCOMPATIBLE 2 7
CHECKCOMPATIBLE 0 8
SORT
NEW bowling 0 1
CHECKCOMPATIBLE 4 10
PRINT
NEW boxing 0 1
CHECKCOMPATIBLE 4 7
PRINT
CHECKCOMPATIBLE 6 10
NEW writing 1 2
NEW flirting 1 3
SORT
PRINT
CHECKCOMPATIBLE 3 8
NEW singing 1 2
PRINT
CHECKCOMPATIBLE 1 4
NEW dancing 1 3
NEW shopping 1 3
PRINT
SORT
CHECKCOMPATIBLE 0 3
CHECKCOMPATIBLE 5 11
NEW cooking 2 3
PRINT
NEW praying 1 3
CHECKCOMPATIBLE 0 17
NEW fishing 0 3
PRINT
SORT
CHECKCOMPATIBLE 8 18
PRINT
NEW hunting 0 3
```

```
SORT
PRINT
CHECKCOMPATIBLE 4 5
CHECKCOMPATIBLE 3 8
CHECKCOMPATIBLE 7 13
CHECKCOMPATIBLE 14 16
CHECKCOMPATIBLE 8 17
CHECKCOMPATIBLE 15 17
CHECKCOMPATIBLE 18 20
CHECKCOMPATIBLE 4 16
CHECKCOMPATIBLE 0 11
CHECKCOMPATIBLE 4 8
CHECKCOMPATIBLE 2 15
CHECKCOMPATIBLE 15 16
CHECKCOMPATIBLE 2 3
CHECKCOMPATIBLE 1 11
CHECKCOMPATIBLE 4 17
CHECKCOMPATIBLE 8 11
CHECKCOMPATIBLE 9 19
CHECKCOMPATIBLE 11 20
CHECKCOMPATIBLE 11 17
CHECKCOMPATIBLE 10 12
CHECKCOMPATIBLE 6 14
CHECKCOMPATIBLE 6 16
CHECKCOMPATIBLE 2 3
CHECKCOMPATIBLE 1 19
CHECKCOMPATIBLE 16 20
CHECKCOMPATIBLE 5 11
CHECKCOMPATIBLE 1 6
CHECKCOMPATIBLE 4 12
CHECKCOMPATIBLE 0 10
CHECKCOMPATIBLE 8 11
CHECKCOMPATIBLE 0 7
CHECKCOMPATIBLE 9 16
CHECKCOMPATIBLE 10 17
CHECKCOMPATIBLE 2 9
CHECKCOMPATIBLE 2 11
CHECKCOMPATIBLE 4 11
CHECKCOMPATIBLE 5 14
CHECKCOMPATIBLE 19 20
CHECKCOMPATIBLE 1 19
```

Sample output 2

```
Current list activities:
biking 1 3

Activities biking and cinema are incompatible

Current list activities:
biking 1 3
cinema 2 3

Current list activities:
biking 1 3
cinema 2 3
jogging 0 3
gym 1 3

Current list activities:
biking 1 3
cinema 2 3
jogging 0 3
gym 1 3
swimming 2 3

Activities jogging and gym are incompatible

Activities gym and swimming are incompatible

Activities cinema and swimming are incompatible

Activities cinema and gym are incompatible

Activities biking and jogging are incompatible

Current list activities:
biking 1 3
cinema 2 3
jogging 0 3
gym 1 3
swimming 2 3
chatting 0 1
climbing 1 2
reading 0 1
siteseeing 1 2

Activities jogging and reading are incompatible

Activities gym and climbing are incompatible

Activities biking and reading are compatible

Current list activities:
biking 1 3
cinema 2 3
jogging 0 3
gym 1 3
swimming 2 3
chatting 0 1
climbing 1 2
reading 0 1
siteseeing 1 2
```

```
strolling 0 1

Activities jogging and reading are incompatible

Activities biking and siteseeing are incompatible

Activities climbing and bowling are compatible

Current list activities:
chatting 0 1
reading 0 1
strolling 0 1
jogging 0 3
climbing 1 2
siteseeing 1 2
biking 1 3
gym 1 3
cinema 2 3
swimming 2 3
bowling 0 1

Activities climbing and gym are incompatible

Current list activities:
chatting 0 1
reading 0 1
strolling 0 1
jogging 0 3
climbing 1 2
siteseeing 1 2
biking 1 3
gym 1 3
cinema 2 3
swimming 2 3
bowling 0 1
boxing 0 1

Activities biking and bowling are compatible

Current list activities:
bowling 0 1
boxing 0 1
chatting 0 1
reading 0 1
strolling 0 1
jogging 0 3
climbing 1 2
siteseeing 1 2
writing 1 2
biking 1 3
flirting 1 3
gym 1 3
cinema 2 3
swimming 2 3

Activities reading and writing are compatible

Current list activities:
bowling 0 1
boxing 0 1
chatting 0 1
```

reading 0 1
strolling 0 1
jogging 0 3
climbing 1 2
siteseeing 1 2
writing 1 2
biking 1 3
flirting 1 3
gym 1 3
cinema 2 3
swimming 2 3
singing 1 2

Activities boxing and strolling are incompatible

Current list activities:
bowling 0 1
boxing 0 1
chatting 0 1
reading 0 1
strolling 0 1
jogging 0 3
climbing 1 2
siteseeing 1 2
writing 1 2
biking 1 3
flirting 1 3
gym 1 3
cinema 2 3
swimming 2 3
singing 1 2
dancing 1 3
shopping 1 3

Activities bowling and reading are incompatible

Activities jogging and dancing are incompatible

Current list activities:
bowling 0 1
boxing 0 1
chatting 0 1
reading 0 1
strolling 0 1
jogging 0 3
climbing 1 2
singing 1 2
siteseeing 1 2
writing 1 2
biking 1 3
dancing 1 3
flirting 1 3
gym 1 3
shopping 1 3
cinema 2 3
swimming 2 3
cooking 2 3

Activities bowling and cooking are compatible

Current list activities:

bowling 0 1
boxing 0 1
chatting 0 1
reading 0 1
strolling 0 1
jogging 0 3
climbing 1 2
singing 1 2
siteseeing 1 2
writing 1 2
biking 1 3
dancing 1 3
flirting 1 3
gym 1 3
shopping 1 3
cinema 2 3
swimming 2 3
cooking 2 3
praying 1 3
fishing 0 3

Activities singing and cooking are compatible

Current list activities:
bowling 0 1
boxing 0 1
chatting 0 1
reading 0 1
strolling 0 1
fishing 0 3
jogging 0 3
climbing 1 2
singing 1 2
siteseeing 1 2
writing 1 2
biking 1 3
dancing 1 3
flirting 1 3
gym 1 3
praying 1 3
shopping 1 3
cinema 2 3
cooking 2 3
swimming 2 3

Current list activities:
bowling 0 1
boxing 0 1
chatting 0 1
reading 0 1
strolling 0 1
fishing 0 3
hunting 0 3
jogging 0 3
climbing 1 2
singing 1 2
siteseeing 1 2
writing 1 2
biking 1 3
dancing 1 3
flirting 1 3

```
gym 1 3
praying 1 3
shopping 1 3
cinema 2 3
cooking 2 3
swimming 2 3

Activities strolling and fishing are incompatible
Activities reading and climbing are compatible
Activities jogging and dancing are incompatible
Activities flirting and praying are incompatible
Activities climbing and shopping are incompatible
Activities gym and shopping are incompatible
Activities cinema and swimming are incompatible
Activities strolling and praying are compatible
Activities bowling and writing are compatible
Activities strolling and climbing are compatible
Activities chatting and gym are compatible
Activities gym and praying are incompatible
Activities chatting and reading are incompatible
Activities boxing and writing are compatible
Activities strolling and shopping are compatible
Activities climbing and writing are incompatible
Activities singing and cooking are compatible
Activities writing and swimming are compatible
```

```
Activities writing and shopping are incompatible
Activities siteseeing and biking are incompatible
Activities hunting and flirting are incompatible
Activities hunting and praying are incompatible
Activities chatting and reading are incompatible
Activities boxing and cooking are compatible
Activities praying and swimming are incompatible
Activities fishing and writing are incompatible
Activities boxing and hunting are incompatible
Activities strolling and biking are compatible
Activities bowling and siteseeing are compatible
Activities climbing and writing are incompatible
Activities bowling and jogging are incompatible
Activities singing and praying are incompatible
Activities siteseeing and shopping are incompatible
Activities chatting and singing are compatible
Activities chatting and writing are compatible
Activities strolling and writing are compatible
Activities fishing and flirting are incompatible
Activities cooking and swimming are incompatible
Activities boxing and cooking are compatible
```

Problem information

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