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Concepts of Programming Languages, Spring Term 2022
Project 1: Quiz Proctoring System Public Tests

Due: 19th *April 2024*

General Project Note The intended structure of the project has assign_proctors as the main predicate and the other predicates as helper predicates. Any other implementation is acceptable as long as it gives correct results.

Testing Notes

- The tests are not exhaustive and you are encouraged to write your own tests.

- Grading is based entirely on the test results.

- There are 3 types of test queries: queries evaluating to true, queries evaluating to false, and queries resulting in variable bindings.

- For some of the tests there are more possible outputs, only a sample of those outputs is shown for readability.

- Generating repeated outputs is not a problem, as long as the output is correct.

- Your code has to output true for any valid assignment/schedule regardless of the order of the TAs in the list.

- the order in which solutions is generated does not matter (which answer comes first).

In this document, you will find test cases organized as:

1) Description Tests (cases that were in the description).

2) assign_quiz Tests

3) assign_quizzes Tests

4) assign_proctors Tests

5) free_schedule Tests

1 Description Tests

Test 1) `?- assign_quiz(quiz(csen403, sun, 5, 2), [day(sat, [[s, m], [m], [m], [m], [s, m]]), day(sun, [[s], [s, h, m], [], [s, m], [s, h, m]]), day(mon, [[s, m], [s, h, m], [s, m], [s, m], [s, h, m]]), day(tue, [[h, m], [h], [h], [h, m], [h]]), day(wed, [[s, h, m], [s, h, m], [s, h], [s, h], [s, h, m]]), day(thu, [[s, h], [h], [h], [s, h], [s, h]])], AssignedTAs)`

output:

```
AssignedTAs = [s, h] ;
AssignedTAs = [h, s] ;
AssignedTAs = [s, m] ;
AssignedTAs = [m, s] ;
AssignedTAs = [h, m] ;
AssignedTAs = [m, h] ;
false.
```

Test 2) `?- assign_quiz(quiz(csen403, sun, 5, 2), [day(sat, [[s, m], [m], [m], [m], [s, m]]), day(sun, [[s], [s, h, m], [], [s, m], [s, h, m]]), day(mon, [[s, m], [s, h, m], [s, m], [s, m], [s, h, m]]), day(tue, [[h, m], [h], [h], [h, m], [h]]), day(wed, [[s, h, m], [s, h, m], [s, h], [s, h], [s, h, m]]), day(thu, [[s, h], [h], [h], [s, h], [s, h]])], [s, h])`

output: true.

Test 3) `?- assign_quiz(quiz(csen403, sun, 5, 7), [day(sat, [[s, m], [m], [m], [m], [s, m]]), day(sun, [[s], [s, h, m], [], [s, m], [s, h, m]]), day(mon, [[s, m], [s, h, m], [s, m], [s, m], [s, h, m]]), day(tue, [[h, m], [h], [h], [h, m], [h]]), day(wed, [[s, h, m], [s, h, m], [s, h], [s, h], [s, h, m]]), day(thu, [[s, h], [h], [h], [s, h], [s, h]])], [s, h])`

output: false.

explanation: csen403 quiz needs 7 proctors but only 2 are assigned.

Test 4) `?- assign_quizzes([quiz(csen403, sun, 5, 2), quiz(csen401, mon, 2, 3)], [day(sat, [[s, m], [m], [m], [m], [s, m]]), day(sun, [[s], [s, h, m], [], [s, m], [s, h, m]]), day(mon, [[s, m], [s, h, m], [s, m], [s, m], [s, h, m]]), day(tue, [[h, m], [h], [h], [h, m], [h]]), day(wed, [[s, h, m], [s, h, m], [s, h], [s, h], [s, h, m]]), day(thu, [[s, h], [h], [h], [s, h], [s, h]])], ProctoringSchedule)`

output:

```
ProctoringSchedule = [proctors(quiz(csen403, sun, 5, 2), [s, h]),
proctors(quiz(csen401, mon, 2, 3), [m, h, s])] ;
ProctoringSchedule = [proctors(quiz(csen403, sun, 5, 2), [h, s]),
proctors(quiz(csen401, mon, 2, 3), [s, h, m])] ;
ProctoringSchedule = [proctors(quiz(csen403, sun, 5, 2), [h, s]),
proctors(quiz(csen401, mon, 2, 3), [s, m, h])] ;
ProctoringSchedule = [proctors(quiz(csen403, sun, 5, 2), [h, s]),
proctors(quiz(csen401 , mon, 2, 3), [h, s, m])] ;
ProctoringSchedule = [proctors(quiz(csen403,  sun, 5, 2), [h, s]),
```

```
        proctors(quiz(csen401, mon, 2, 3), [h, m, s])] ;
        ...
```

Test 5) `?- assign_quizzes([quiz(csen403, sun, 5, 2), quiz(csen401, mon, 2, 3)],`
`    [day(sat, [[s, m], [m], [m], [m], [s, m]]),`
`    day(sun, [[s], [s, h, m], [], [s, m], [s, h, m]]),`
`    day(mon, [[s, m], [s, h, m], [s, m], [s, m], [s, h, m]]),`
`    day(tue, [[h, m], [h], [h], [h, m], [h]]),`
`    day(wed, [[s, h, m], [s, h, m], [s, h], [s, h], [s, h, m]]),`
`    day(thu, [[s, h], [h], [h], [s, h], [s, h]])],`
`    [proctors(quiz(csen403, sun, 5, 2), [s, h]),`
`                    proctors(quiz(csen401, mon, 2, 3), [s, h, m])])`

output: true.

Test 6) `?- assign_quizzes([quiz(csen403, sun, 5, 2), quiz(csen401, mon, 2, 3)], [da`
`y(sat, [[s, m], [m], [m], [m], [s, m]]), day(sun, [[s], [s, h, m], [], [`
`s, m], [s, h, m]]), day(mon, [[s, m], [s, h, m], [s, m], [s, m], [s, h,`
`m]]), day(tue, [[h, m], [h], [h], [h, m], [h]]), day(wed, [[s, h, m], [s`
`, h, m], [s, h], [s, h], [s, h, m]]), day(thu, [[s, h], [h], [h], [s, h]`
`, [s, h]])], [proctors(quiz(csen403, sun, 5, 2), [s, h]), proctors(quiz(`
`csen401, mon, 2, 3), [s, h])])`

output: false.

explanation: csen401 quiz needs 3 proctors but only 2 are assigned.

Test 7) `?- free_schedule([ta(s,tue), ta(h,sat), ta(m,thu)], [day(sat, [[], [s], [s]`
`, [s], []]), day(sun, [[m, h], [], [s, m, h], [h], []]), day(mon, [[h],`
`[], [h], [h], []]), day(tue, [[], [m], [m], [], [m]]), day(wed, [[], [],`
`[m], [m], []]), day(thu, [[], [s], [s], [], []])], FreeSchedule)`

output:

```
 FreeSchedule = [day(sat, [[s, m], [m], [m], [m], [s, m]]), day(sun, [[s]
, [s, h, m], [], [s, m], [s, h, m]]), day(mon, [[s, m], [s, h, m], [s, m
], [s, m], [s, h, m]]), day(tue, [[h, m], [h], [h], [h, m], [h]]), day(w
ed, [[s, h, m], [s, h, m], [s, h], [s, h], [s, m, h]]), day(thu, [[s, h]
, [h], [h], [s, h], [s, h]])] ;
FreeSchedule = [day(sat, [[s, m], [m], [m], [m], [s, m]]),
day(sun, [[s], [s, h, m], [], [s, m], [s, h, m]]),
day(mon, [[s, m], [s, h, m], [s, m], [s, m], [s, h, m]]), day(tue, [[h, m]
, [h], [h], [h, m], [h]]), day(wed, [[s, h, m], [s, h, m], [s, h], [s, h
], [s, m, h]]), day(thu, [[s, h], [h], [h], [s, h], [h, s]])] ;
FreeSchedule = [day(sat, [[s, m], [m], [m], [m], [s, m]]), day(sun, [[s], [s, h,
 m], [], [s, m], [s, h, m]]), day(mon, [[s, m], [s, h, m], [s, m], [s, m
], [s, h, m]]), day(tue, [[h, m], [h], [h], [h, m], [h]]), day(wed, [[s,
 h, m], [s, h, m], [s, h], [s, h], [s, m, h]]), day(thu, [[s, h], [h], [h],
 [h, s], [s, h]])] ;
...
```

Test 8) `?- free_schedule([ta(s,tue), ta(h,sat), ta(m,thu)], [day(sat, [[], [s], [s]`
`, [s], []]), day(sun, [[m, h], [], [s, m, h], [h], []]), day(mon, [[h],`
`[], [h], [h], []]), day(tue, [[], [m], [m], [], [m]]), day(wed, [[], [],`
`[m], [m], []]), day(thu, [[], [s], [s], [], []])], [day(sat, [[s, m], [`
`m], [m], [m], [s, m]]), day(sun, [[s], [s, h, m], [], [s, m], [s, h, m]]`
`), day(mon, [[s, m], [s, h, m], [s, m], [s, m], [s, h, m]]), day(tue, [[`
`h, m], [h], [h], [h, m], [h]]), day(wed, [[s, h, m], [s, h, m], [s, h],`
`[s, h], [s, h, m]]), day(thu, [[s, h], [h], [h], [s, h], [s, h]])])`

output: true.

Test 9) `?- free_schedule([ta(s,tue), ta(h,sat), ta(m,thu)],`
`[day(sat, [[], [s], [s], [s], []]), day(sun, [[m, h], [], [s, m, h], [h], []]),`
`day(mon, [[h], [], [h], [h], []]), day(tue, [[], [m], [m], [], [m]]),`
`day(wed, [[], [], [m], [m], []]), day(thu, [[], [s], [s], [], []])],`
`[day(sat, [[s, m], [m,h], [m], [m], [s, m]]),`
`day(sun, [[s], [s, h, m], [], [s, m], [s, h, m]]),`
`day(mon, [[s, m], [s, h, m], [s, m], [s, m], [s, h, m]]),`
`day(tue, [[h, m], [h], [h], [h, m], [h]]),`
`day(wed, [[s, h, m], [s, h, m], [s, h], [s, h], [s, h, m]]),`
`day(thu, [[s, h], [h], [h], [s, h], [s, h]])])`

output: false.

explanation: Saturday 2nd slot should have only m.

Test 10) `?- assign_proctors([ta(s,tue), ta(h,tue), ta(m,thu), ta(a,sat)], [quiz(csen`
`403, sun, 5, 2), quiz(csen401, mon, 2, 3)], [day(sat, [[], [s], [s], [s]`
`, []]), day(sun, [[m, h], [], [s, m, h], [h], []]), day(mon, [[h], [], [`
`h], [h], []]), day(tue, [[], [m], [m], [], [m]]), day(wed, [[], [], [m],`
`[m], []]), day(thu, [[], [s], [s], [], []])], ProctoringSchedule)`

output:

```
 ProctoringSchedule = [proctors(quiz(csen403, sun, 5, 2), [s, m]), procto
rs(quiz(csen401, mon, 2, 3), [m, h, a])] ;
ProctoringSchedule = [proctor
s(quiz(csen403, sun, 5, 2), [s, m]), proctors(quiz(csen401, mon, 2, 3),
[m, a, h])] ;
ProctoringSchedule = [proctors(quiz(csen403, sun, 5, 2), [
s, m]), proctors(quiz(csen401, mon, 2, 3), [a, h, m])] ;
ProctoringSched
ule = [proctors(quiz(csen403, sun, 5, 2), [s, m]), proctors(quiz(csen401
, mon, 2, 3), [a, m, h])] ;
ProctoringSchedule = [proctors(quiz(csen403,
 sun, 5, 2), [m, s]), proctors(quiz(csen401, mon, 2, 3), [s, h, m])] ;
...
```

Test 11) `?- assign_proctors([ta(s,tue), ta(h,tue), ta(m,thu), ta(a,sat)], [quiz(csen`
`403, sun, 5, 2), quiz(csen401, mon, 2, 3)], [day(sat, [[], [s], [s], [s]`
`, []]), day(sun, [[m, h], [], [s, m, h], [h], []]), day(mon, [[h], [], [`
`h], [h], []]), day(tue, [[], [m], [m], [], [m]]), day(wed, [[], [], [m],`
`[m], []]), day(thu, [[], [s], [s], [], []])], [proctors(quiz(csen403, s`
`un, 5, 2), [s, h]), proctors(quiz(csen401, mon, 2, 3), [s, h, m])])`

output: true.

Test 12) `?- assign_proctors([ta(s,tue), ta(h,tue), ta(m,thu), ta(a,sat)], [quiz(csen 403, sun, 5, 2), quiz(csen401, mon, 2, 7)], [day(sat, [[], [s], [s], [s] , []]), day(sun, [[m, h], [], [s, m, h], [h], []]), day(mon, [[h], [], [h], [h], []]), day(tue, [[], [m], [m], [], [m]]), day(wed, [[], [], [m], [m], []]), day(thu, [[], [s], [s], [], []])], [proctors(quiz(csen403, s un, 5, 2), [s, h]), proctors(quiz(csen401, mon, 2, 7), [s, h, m])])`

output: false.

explanation: csen401 quiz needs 7 proctors but only 7 are assigned.

2 assign_quiz Tests

Test 13) `?- assign_quiz(quiz(csen403, sun, 5, 3), [day(sat, [[a], [], [a], [a], [a]]), day(sun, [[], [a], [a], [a], [a]]), day(mon, [[a], [a], [a], [a], [a]]), day(tue, [[a], [a], [a], [a], [a]]), day(wed, [[a], [a], [a], [a], [a]]), day(thu, [[], [], [], [], []])] , [a])`

output: false.

explanation: not enough proctors

Test 14) `?- assign_quiz(quiz(csen403, sun, 5, 1), [day(sat, [[s, m], [m], [m], [m], [s, m]]), day(sun, [[s], [s, h, m], [], [s, m], [s, h, m]]), day(mon, [[s, m], [s, h, m], [s, m], [s, m], [s, h, m]]), day(tue, [[h, m], [h], [h], [h, m], [h]]), day(wed, [[s, h, m], [s, h, m], [s, h], [s, h], [s, h, m]]), day(thu, [[s, h], [h], [h], [s, h], [s, h]])], [s, h])`

output: false.

explanation: too many proctors

Test 15) `?- assign_quiz(quiz(csen403, thu, 4, 1), [day(sat, [[a], [], [a], [a], [a]]), day(sun, [[], [a], [a], [a], [a]]), day(mon, [[a], [a], [a], [a], [a]]), day(tue, [[a], [a], [a], [a], [a]]), day(wed, [[a], [a], [a], [a], [a]]), day(thu, [[], [], [], [], []])] , [a])`

output: false.

explanation: proctors assigned on their day off

Test 16) `?- assign_quiz(quiz(csen403, sun, 1, 1), [day(sat, [[a], [], [a], [a], [a]] ), day(sun, [[], [a], [a], [a], [a]]), day(mon, [[a], [a], [a], [a], [a] ]), day(tue, [[a], [a], [a], [a], [a]]), day(wed, [[a], [a], [a], [a], [ a]]), day(thu, [[], [], [], [], []])] , [a])`

output: false.

explanation: proctors assigned during teaching

Test 17) ?- assign_quiz(quiz(csen1003, thu, 1, 2),
    [day(sat, [[], [], [], [], []]),
    day(sun, [[y], [m, r, y], [m, r, y], [y], [m, y]]),
    day(mon, [[r, y], [m , r, y], [r, y], [m, r, y], [m, r, y]]),
    day(tue, [[m, r, y], [r], [m, r , y], [r], [m, r]]),
    day(wed, [[m], [m], [m], [m, r], [m, r, y]]),
    day(thu, [[m, r, y], [m, r, y], [m, r, y], [m, r, y], [y, r, m]])],
    [m, r])

output: true.

Test 18) ?- assign_quiz(quiz(csen403, sun, 5, 1),
    [day(sat, [[a], [], [a], [a], [a]]), day(sun, [[], [a], [a], [a], [a]]),
    day(mon, [[a], [a], [a], [a], [a]]), day(tue, [[a], [a], [a], [a], [a]]),
    day(wed, [[a], [a], [a], [a], [a]]), day(thu, [[], [], [], [], []])] , [a])

output: true.

Test 19) ?- assign_quiz(quiz(csen1003, thu, 1, 2),
    [day(sat, [[], [], [], [], []]), day(sun, [[y], [m, r, y], [m, r, y], [y], [m, y]]),
    day(mon, [[r, y], [m, r, y], [r, y], [m, r, y], [m, r, y]]),
    day(tue, [[m, r, y], [r], [m, r, y], [r], [m, r]]),
    day(wed, [[m], [m], [m], [m, r], [m, r, y]]),
    day(thu, [[m, r, y], [m, r, y], [m, r, y], [m, r, y], [y, r, m]])], P)

output:

    P = [m, r] ;
    P = [r, m] ;
    P = [m, y] ;
    P = [y, m] ;
    P = [r, y] ;
    P = [y, r] ;
    false.

Test 20) ?- assign_quiz(quiz(csen403, sun, 5, 1), [day(sat, [[a], [], [a], [a], [a]]
    ), day(sun, [[], [a], [a], [a], [a]]), day(mon, [[a], [a], [a], [a], [a]
    ]), day(tue, [[a], [a], [a], [a], [a]]), day(wed, [[a], [a], [a], [a], [
    a]]), day(thu, [[], [], [], [], []])] , P)

output:

     P = [a] ;
    false.

3 assign_quizzes Tests

Test 21) ?- assign_quizzes([quiz(csen403, sun, 5, 2), quiz(csen401, mon, 2, 3)],
[day(sat, [[s, m], [m], [m], [m], [s, m]]),
day(sun, [[s], [s, h, m], [], [s, m], [s, h, m]]),
day(mon, [[s, m], [s, h, m], [s, m], [s, m], [s, h, m]]),
day(tue, [[h, m], [h], [h], [h, m], [h]]),
day(wed, [[s, h, m], [s, h, m], [s, h], [s, h], [s, h, m]]),
day(thu, [[s, h], [h], [h], [s, h] , [s, h]])],
[proctors(quiz(csen403, sun, 5, 2), [s, h])])

output: false.

explanation: missing quiz

Test 22) ?- assign_quizzes([quiz(csen403, sun, 5, 2), quiz(csen401, mon, 2, 3)],
[day(sat, [[s, m], [m], [m], [m], [s, m]]),
day(sun, [[s], [s, h, m], [], [s, m], [s, h, m]]),
day(mon, [[s, m], [s, h, m], [s, m], [s, m], [s, h, m]]),
day(tue, [[h, m], [h], [h], [h, m], [h]]),
day(wed, [[s, h, m], [s , h, m], [s, h], [s, h], [s, h, m]]),
day(thu, [[s, h], [h], [h], [s, h] , [s, h]])],
[proctors(quiz(csen403, sun, 5, 2), [s, h]),
proctors(quiz(csen401, mon, 2, 3), [s, h]),
proctors(quiz(csis, wed, 5, 1), [m])])

output: false.

explanation: extra quiz

Test 23) ?- assign_quizzes([quiz(csen403, sun, 5, 1), quiz(csen602, mon, 5, 3),quiz(csen1003, th
[day(sat, [[], [], [], [], []]),
day(sun, [[y], [m, r, y], [m, r, y], [y], [m, y]]),
day(mon, [[r, y], [m, r, y], [r, y], [m, r, y], [m, r, y]]),
day(tue, [[m, r, y], [r], [m, r, y], [r], [m, r]]),
day(wed, [[m], [m], [m], [m, r], [m, r, y]]),
day(thu, [[m, r, y], [m, r, y], [m, r, y], [m, r, y], [y, r, m]])],
[proctors(quiz(csen403, sun, 5, 1), [m]),
proctors(quiz(csen602, mon, 5, 3), [m, r, y]),
proctors(quiz(csen1003, thu, 1, 2), [m, r])])

output: true.

Test 24) ?- assign_quizzes([quiz(csen403, sun, 5, 1),quiz(csen1003, wed, 1, 1)],
[day(sat, [[a], [], [a], [a], [a]]), day(sun, [[], [a], [a], [a], [a]]),
day(mon, [[a], [a], [a], [a], [a]]), day(tue, [[a], [a], [a], [a], [a]]),
day(wed, [[a], [a], [a], [a], [a]]), day(thu, [[], [], [], [], []])] ,
[proctors(quiz(csen403, sun, 5, 1), [a]), proctors(quiz(csen1003, wed, 1, 1), [a])]).

output: true.

Test 25) ?- assign_quizzes([quiz(csen403, sun, 5, 1), quiz(csen602, mon, 5, 3),
         quiz(csen1003, thu, 1, 2)],
     [day(sat, [[], [], [], [], []]),
         day(sun, [[y], [m, r, y], [m, r, y], [y], [m, y]]),
         day(mon, [[r, y], [m, r, y], [r, y], [m, r, y], [m, r, y]]),
         day(tue, [[m, r, y], [r], [m, r, y], [r], [m, r]]),
         day(wed, [[m], [m], [m], [m, r], [m, r, y]]),
         day(thu, [[m, r, y], [m, r, y], [m, r, y], [m, r, y], [y, r, m]])], P)

output:

     P = [proctors(quiz(csen403, sun, 5, 1), [m]),
         proctors(quiz(csen602, mon, 5, 3), [m, r, y]),
         proctors(quiz(csen1003, thu, 1, 2), [m, r])] ;
     P = [proctors(quiz(csen403, sun, 5, 1), [m]),
         proctors(quiz(csen602, mon, 5, 3), [m, r, y]),
         proctors(quiz(csen1003, thu, 1, 2), [r, m])] ;
     P = [proctors(quiz(csen403, sun, 5, 1), [m]),
         proctors(quiz(csen602, mon, 5, 3), [m, r, y]),
         proctors(quiz(csen1003, thu, 1, 2), [m, y])] ;
     P = [proctors(quiz(csen403, sun, 5, 1), [m]),
         proctors(quiz(csen602, mon, 5, 3), [m, r, y]),
         proctors(quiz(csen1003, thu, 1, 2), [y, m])] ;
     P = [proctors(quiz(csen403, sun, 5, 1), [m]),
         proctors(quiz(csen602, mon, 5, 3), [m, r, y]),
         proctors(quiz(csen1003, thu, 1, 2), [r, y])] ;
     ...

Test 26) ?- assign_quizzes([quiz(csen403, sun, 5, 1),quiz(csen1003, wed, 1, 1)],
     [day(sat, [[a], [], [a], [a], [a]]), day(sun, [[], [a], [a], [a], [a]]),
     day(mon, [[a], [a], [a], [a], [a]]), day(tue, [[a], [a], [a], [a], [a]]),
     day(wed, [[a], [a], [a], [a], [a]]), day(thu, [[], [], [], [], []])] , P).

output:

     P = [proctors(quiz(csen403, sun, 5, 1), [a]),
     proctors(quiz(csen1003, wed, 1, 1), [a])] ;
     false.

4 assign_proctors Tests

Test 27) `?- assign_proctors([ta(a, thu)],[quiz(csen403, sun, 5, 1)], [day(sat, [[],`
`[a], [], [], []]), day(sun, [[a], [], [], [], []]), day(mon, [[], [], []`
`, [], []]), day(tue, [[], [], [], [], []]), day(wed, [[], [], [], [], []`
`]), day(thu, [[], [], [], [], []])], [proctors(quiz(csen403, sun, 5, 1),`
`[b])]).`

output: false.

explanation: someone not in TA list is assigned

Test 28) `?- assign_proctors([ta(a, thu)],[quiz(csen403, sun, 5, 1)],`
`[day(sat, [[], [a], [], [], []]), day(sun, [[a], [], [], [], []]),`
`day(mon, [[], [], [], [], []]), day(tue, [[], [], [], [], []]),`
`day(wed, [[], [], [], [], [] ]), day(thu, [[], [], [], [], []])],`
`[proctors(quiz(csen403, sun, 5, 1),    [a])]).`

output: true.

Test 29) `?- assign_proctors([ ta(m,sat), ta(r, sat), ta(y, sat)],`
`[quiz(csen403, sun, 5, 1), quiz(csen602, mon, 5, 3),quiz(csen1003, thu, 1, 2)],`
`[day(sat, [[], [], [], [], []]), day(sun, [[r, m], [], [], [m, r], [r]]),`
`day(mon, [[m], [], [m], [], []]), day(tue, [[], [m, y], [], [m, y], [y]]),`
`day(wed, [[r, y], [r, y], [y, r], [y], []]), day(thu, [[], [], [], [], []])],`
`[proctors(quiz(csen403, sun, 5, 1), [m]),`
`proctors(quiz(csen602, mon, 5, 3), [m, y,r]),`
`proctors(quiz(csen1003, thu, 1, 2), [r, y])]).`

output: true.

Test 30) `?- assign_proctors([ta(a, thu)],[quiz(csen403, sun, 5, 1)], [day(sat, [[],`
`[a], [], [], []]), day(sun, [[a], [], [], [], []]), day(mon, [[], [], []`
`, [], []]), day(tue, [[], [], [], [], []]), day(wed, [[], [], [], [], []`
`]), day(thu, [[], [], [], [], []])], X).`

output:

```
X = [proctors(quiz(csen403, sun, 5, 1), [a])] ;
false.
```

Test 31) `?- assign_proctors([ ta(m,sat), ta(r, sat), ta(y, sat)],[quiz(csen403, sun,`
`5, 1), quiz(csen602, mon, 5, 3),quiz(csen1003, thu, 1, 2)],`
`[day(sat, [[], [], [], [], []]), day(sun, [[r, m], [], [], [m, r], [r]]),`
`day(mon, [[m], [], [m], [], []]), day(tue, [[], [m, y], [], [m, y], [y]]),`
`day(wed, [[r, y], [r, y], [y, r], [y], []]), day(thu, [[], [], [], [], []])], P).`

output:

```
P = [proctors(quiz(csen403, sun, 5, 1), [m]),
        proctors(quiz(csen602, mon , 5, 3), [m, r, y]),
        proctors(quiz(csen1003, thu, 1, 2), [m, r])] ;
P = [proctors(quiz(csen403, sun, 5, 1), [m]),
        proctors(quiz(csen602, mon, 5, 3), [m, r, y]),
        proctors(quiz(csen1003, thu, 1, 2), [r, m])] ;
```

```
P = [proctors(quiz(csen403, sun, 5, 1), [m]),
        proctors(quiz(csen602, mon, 5, 3), [m, r, y]),
        proctors(quiz(csen1003, thu, 1, 2), [m, y])] ;
P = [proctors(quiz(csen403, sun, 5, 1), [m]),
        proctors(quiz(csen602, mon, 5, 3), [m, r, y]),
        proctors(quiz(csen1003, thu, 1, 2), [y, m])] ;
P = [proctors(quiz(csen403, sun, 5, 1), [m]),
        proctors(quiz(csen602, mon, 5, 3), [m, r, y]),
        proctors(quiz(csen1003, thu, 1, 2), [r, y])] ;
P = [proctors(quiz(csen403, sun, 5, 1), [m]),
        proctors(quiz(csen602, mon, 5, 3), [m, r, y]),
        proctors(quiz(csen1003, thu, 1, 2), [y, r])] ;
P = [proctors(quiz(csen403, sun, 5, 1), [m]),
        proctors(quiz(csen602, mon, 5, 3), [m, y, r]),
        proctors(quiz(csen1003, thu, 1, 2), [m, r])] ;
P = [proctors(quiz(csen403, sun, 5, 1), [m]),
        proctors(quiz(csen602, mon, 5, 3), [m, y, r]),
        proctors(quiz(csen1003, thu, 1, 2), [r, m])] ;
P = [proctors(quiz(csen403, sun, 5, 1), [m]),
        proctors(quiz(csen602, mon, 5, 3), [m, y, r]),
        proctors(quiz(csen1003, thu, 1, 2), [m, y])] ;
P = [proctors(quiz(csen403, sun, 5, 1), [m]),
        proctors(quiz(csen602, mon, 5, 3), [m, y, r]),
        proctors(quiz(csen1003, thu, 1, 2), [y, m])] ;
...
```

5   free_schedule Tests

Test 32)
```
?- free_schedule([ ta(a,thu)],
    [day(sat, [[], [a], [], [], []]), day(sun, [[a], [], [], [], []]),
      day(mon, [[], [], [], [], []]), day(tue, [[], [], [], [], []]),
      day(wed, [[], [], [], [], []]), day(thu, [[], [], [], [], []])],
    [day(sat, [[a], [a], [a], [a], [a]]), day(sun, [[], [a], [a], [a], [a]]),
      day(mon, [[a], [a], [a], [a], [a]]), day(tue, [[a], [a], [a], [a], [a]]),
      day(wed, [[a], [a], [a], [a], [a]]), day(thu, [[], [], [], [], []])] )
```
output: false.

explanation: TA counted free on a teaching slot

Test 33)
```
?- free_schedule([ ta(a,thu)],
    [day(sat, [[], [a], [], [], []]), day(sun, [[a], [], [], [], []]),
      day(mon, [[], [], [], [], []]), day(tue, [[], [], [], [], []]),
      day(wed, [[], [], [], [], []]), day(thu, [[], [], [], [], []])],
    [day(sat, [[a], [a], [a], [a], [a]]), day(sun, [[], [a], [a], [a], [a]]),
      day(mon, [[a], [a], [a], [a], [a]]), day(tue, [[a], [a], [a], [a], [a]]),
      day(wed, [[a], [a], [a], [a], [a]]), day(thu, [[a], [a], [a], [a], [a]])] )
```
output: false.

explanation: TA counted free on a day off

Test 34) ?- free_schedule([ta(a,thu)],
        [day(sat, [[], [a], [], [], []]), day(sun, [[a], [], [], [], []]),
            day(mon, [[], [], [], [], []]), day(tue, [[], [], [], [], []]),
            day(wed, [[], [], [], [], []]), day(thu, [[], [], [], [], []])],
        [day(sat, [[a], [], [a], [a], [a]]), day(sun, [[], [a], [a], [a], [a]]),
            day(mon, [[a], [a], [a], [a], [a]]), day(tue, [[a], [a], [a], [a], [a]]),
            day(wed, [[a], [a], [a], [a], [a]]), day(thu, [[], [], [], [], []])])

output: true.

?- free_schedule([ta(m,sat), ta(r, sat), ta(y, sat)],
        [day(sat, [[], [], [], [], []]), day(sun, [[r, m], [], [], [m, r], [r]]),
            day(mon, [[m], [], [m], [], []]), day(tue, [[], [m, y], [], [m, y], [y]]),
            day(wed, [[r, y], [r, y], [y, r], [y], []]), day(thu, [[], [], [], [], []])],
        [day(sat, [[], [], [], [], []]),
            day(sun, [[y], [m, r, y], [m, r, y], [y], [m, y]]),
            day(mon, [[r, y], [m, r, y], [r, y], [m, r, y], [m, r, y]]),
            day(tue, [[m, r, y], [r], [m, r, y], [r], [m, r]]),
            day(wed, [[m], [m], [m], [m, r], [m, r, y]]),
            day(thu, [[m, r, y], [m, r, y], [m, r, y], [m, r, y], [y, r, m]])]).

output: true.

Test 36) ?- free_schedule([ta(a,thu)],
        [day(sat, [[], [a], [], [], []]),
         day(sun, [[a], [], [], [], []]),
         day(mon, [[], [], [], [], []]),
         day(tue, [[], [], [], [], []]),
         day(wed, [[], [], [], [], []]),
         day(thu, [[], [], [], [], []])], A).

output:

 A = [day(sat, [[a], [], [a], [a], [a]]),
    day(sun, [[], [a], [a], [a], [a]]),
    day(mon, [[a], [a], [a], [a], [a]]),
    day(tue, [[a], [a], [a], [a], [a]]),
    day(wed, [[a], [a], [a], [a], [a]]),
    day(thu, [[], [], [], [], []])] ;
    false.

?- free_schedule([ta(m,sat), ta(r, sat), ta(y, sat)],
        [day(sat, [[], [], [], [], []]), day(sun, [[r, m], [], [], [m, r], [r]]),
         day(mon, [[m], [], [m], [], []]), day(tue, [[], [m, y], [], [m, y], [y]]),
         day(wed, [[r, y], [r, y], [y, r], [y], []]), day(thu, [[], [], [], [], []])], A).

output:

A = [day(sat, [[], [], [], [], []]),
    day(sun, [[y], [m, r, y], [m, r, y], [y], [m, y]]),
    day(mon, [[r, y], [m, r, y], [r, y], [m, r, y], [m, r, y]]),
    day(tue, [[m, r, y], [r], [m, r, y], [r], [m, r]]),
    day(wed, [[m], [m], [m], [m, r], [m, r, y]]),
    day(thu, [[m, r, y], [m, r, y], [m, r, y], [m, r, y], [m, r, y]])] ;

```
A = [day(sat, [[], [], [], [], []]),
     day(sun, [[y], [m, r, y], [m, r, y], [y], [m, y]]),
     day(mon, [[r, y], [m, r, y], [r, y], [m, r, y], [m, r, y]]),
     day(tue, [[m, r, y], [r], [m, r, y], [r], [m, r]]),
     day(wed, [[m], [m], [m], [m, r], [m, r, y]]),
     day(thu, [[m, r, y], [m, r, y], [m, r, y], [m, r, y], [m, y, r]])] ;
A = [day(sat, [[], [], [], [], []]),
     day(sun, [[y], [m, r, y], [m, r, y], [y], [m, y]]),
     day(mon, [[r, y], [m, r, y], [r, y], [m, r, y], [m, r, y]]),
     day(tue, [[m, r, y], [r], [m, r, y], [r], [m, r]]),
     day(wed, [[m], [m], [m], [m, r], [m, r, y]]),
     day(thu, [[m, r, y], [m, r, y], [m, r, y], [m, r, y], [r, m, y]])] ;
A = [day(sat, [[], [], [], [], []]),
     day(sun, [[y], [m, r, y], [m, r, y], [y], [m, y]]),
     day(mon, [[r, y], [m, r, y], [r, y], [m, r, y], [m, r, y]]),
     day(tue, [[m, r, y], [r], [m, r, y], [r], [m, r]]),
     day(wed, [[m], [m], [m], [m, r], [m, r, y]]),
     day(thu, [[m, r, y], [m, r, y], [m, r, y], [m, r, y], [r, y, m]])] ;
A = [day(sat, [[], [], [], [], []]),
     day(sun, [[y], [m, r, y], [m, r, y], [y], [m, y]]),
     day(mon, [[ r, y], [m, r, y], [r, y], [m, r, y], [m, r, y]]),
     day(tue, [[m, r, y], [ r], [m, r, y], [r], [m, r]]),
     day(wed, [[m], [m], [m], [m, r], [m, r, y]]),
     day(thu, [[m, r, y], [m, r, y], [m, r, y], [m, r, y], [y, m, r]])] ;
A = [day(sat, [[], [], [], [], []]),
     day(sun, [[y], [m, r, y], [m, r, y ], [y], [m, y]]),
     day(mon, [[r, y], [m, r, y], [r, y], [m, r, y], [m, r, y]]),
     day(tue, [[m, r, y], [r], [m, r, y], [r], [m, r]]),
     day(wed, [[m] , [m], [m], [m, r], [m, r, y]]),
     day(thu, [[m, r, y], [m, r, y], [m, r, y], [m, r, y], [y, r, m]])] ;
A = [day(sat, [[], [], [], [], []]),
     day(sun, [[y], [m, r, y], [m, r, y], [y], [m, y]]),
     day(mon, [[r, y], [m, r, y], [r, y], [m, r, y], [m, r, y]]),
     day(tue, [[m, r, y], [r], [m, r, y], [r], [m, r]]),
     day(wed, [[m], [m], [m], [m, r], [m, r, y]]),
     day(thu, [[m, r, y], [m, r, y], [m, r, y], [m, y, r], [m, r, y]])];
...
```