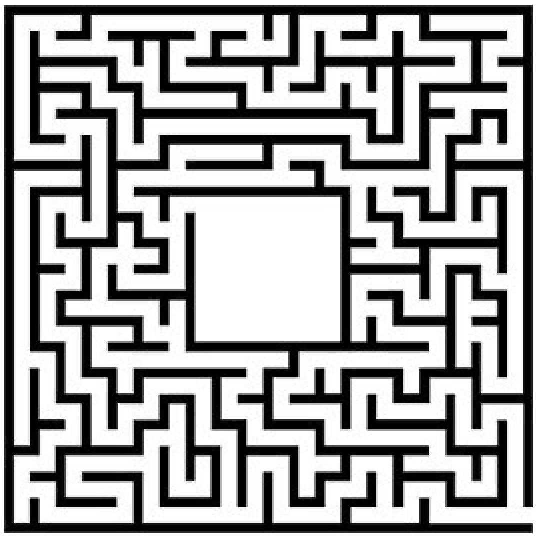
Artificial Intelligence BTI7510 BFH TI Bern

Prolog project for BFH TI "Artifical Intelligence", BTI7510 by Bruno Fernandez & Claudio Polo Date: 15.06.2018



About

The idea of this project is to find a way from room x to room y. Problems to solve ->

- the maze and rooms are bi-directed graphs -> problem of looping
- return only the shortest way
- police officer appears randomly in room8, room10, room11 or room12
- there is a bomb that can explode a wall (%%%%)

Some help from:

- http://tcl.sfs.uni-tuebingen.de/~cornell/prolog/Graphs003.html
- https://www.cpp.edu/~jrfisher/www/prolog_tutorial/2_15.html

Labyrinth

```
+--------+--------+--------+--------+--------+
| START    Room2 #  Room3    Room24   Room4  |
+--------+--------+--------+--------+--    --+
| Room5  |                          | Room6  |
+--    --+--------+--------+--------+--    --+
| Room7    Room23   Room22   Room11   Room8  |
+--    --+--------+--------+--    --+--    --+
| Room9  |                  | Room12   Room10 |
+--    --+--------+         +--------+--%%%%--+
| Room13   Room14 |                 | Room21 |
+--------+--    --+--------+        +--    --+
         | Room15     End  |        | Room20 |
         +--    --+--    --+--------+--    --+
         | Room16 | Room17   Room18   Room19 |
         +--------+--------+--------+--------+

        %%%%                             -> wall to explode
        #                                -> bomb to collected
        room8, room10, room11, room12    -> possible rooms the police officer can
be located
```

How to run

To run the code please start the following main method with 3 variables. For example:

```
main(Waylist, Policepos, Cost)
```

Then it will return the shortest path with the following information

- Waylist: the list of the shortest path
- Policepos: random position of the police officer
- Cost: how much hops you needed to reach the end
- Depending on whether the figure is caught or not, you will receive one of those messages to the console:
    - You have found a way to escape!
    - The police caught you!

Here are two examples:

```
?- main(Waylist, Policepos, Cost).
You have found a way to escape!
Waylist =
[start,room2,room3,room24,room4,room6,room8,room10,room21,room20,room19,room18,roo
m17,end],
Policepos = room12,
Cost = 14.
```

```
?- main(Waylist, Policepos, Cost).
The police caught you!
Waylist =
[start,room2,room3,room24,room4,room6,room8,room10,room21,room20,room19,room18,roo
m17,end],
Policepos = room10,
Cost = 14
```

Hint: to see the whole list, run the following command on the console

```
set_prolog_flag(answer_write_options,[max_depth(100)]).
```

Some explanations for the code

Rooms

A door connects two rooms. So this is the logical fact or relationship of both rooms. Here an example for the first room:

```
door(start,room2).
```

If room A is connected with room B, then room B also connected with room A. With this rule, we bypassed the long list of creating both relations:

```
connected(X,Y) :- door(X,Y) ; door(Y,X).
```

Ways and walk

To find all possible ways, we use a recursive depth first search function. As input

```
way(X,Y,Waylist) :-
       walk(X,Y,[X],Z),
       reverse(Z,Waylist).
walk(X,Y,Roomlist,[Y|Roomlist]) :-
       (connected(X,Y);blowwall(X,Y,Roomlist)) .
walk(X,Y,Roomlist,Path) :-
       (connected(X,Z);blowwall(X,Z,Roomlist)),
       Z \== Y,
       \+member(Z,Roomlist),
       walk(Z,Y,[Z|Roomlist],Path).
```

As we only want the shortest path, we return only the path with the smallest number of rooms (hops):

```
shortestPath(X, Y, L, N) :-
        length(L, N),
        way(X, Y, L),!.
```

Bomb

The bomb rule works as follow:

- X is the room where the bomb is located
- Y and Z are the rooms which can be connected if you explode the wall with a bomb

```
bomb(X,Y,Z).
```

Now if you have passed the room where the bomb was located and you reach the room where you can explode the wall, the new room will be added do the possible rooms.

```
blowwall(X,Y,Roomlist):-
        (bomb(B, X, Y); bomb(B, Y, X)),
        member(B,Roomlist), !.
```

Police

The police rule defines a list of possible rooms where the police officer can be locaded:

```
police([room11,room8,room12,room10]).
```

Now, each time you start the main code, the police is randomly set in on those rooms

```
getPolList(X) :- police(Y), random_member(X, Y).
```

Known errors

Those errors/problems are known and will be resolved in a later release

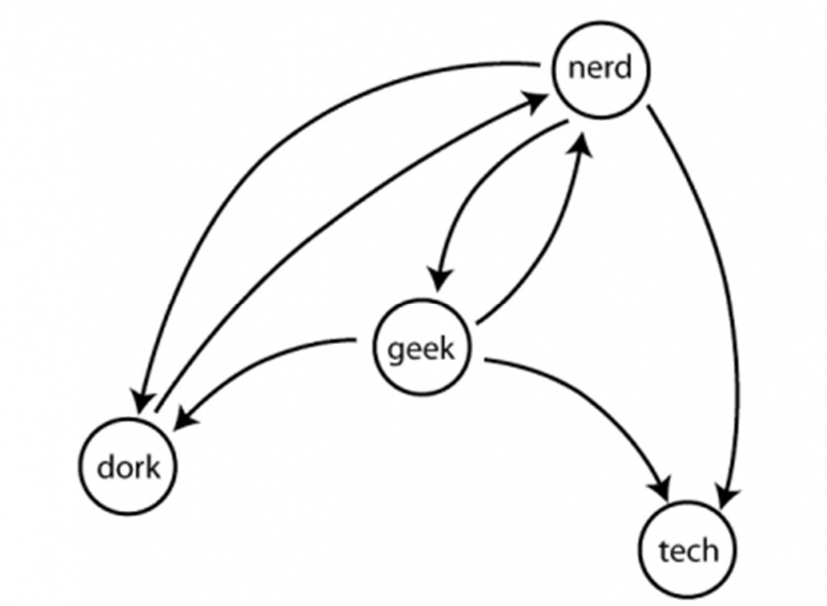
- Some times it just returns a false message and it can't find any way to the end room. No idea why
- If we have found multiple ways with the same path length, it just returns the first one.
- extend the code to find another way if the police officer is blocking the path

Personal review

In this project we worked for the first time with a "logical programming language" like Prolog. We noticed that you have to leave behind the knowhow of the procedural development and you have to change your approach how to solve the problem. It takes a lot of rethinking in the beginning to handle this language.

As long as you only work with prolog facts, it is still manageable. But as soon as you start with prolog rules, it quickly becomes difficult. Especially if you have to solve certain problem with recursion, it quickly becomes unmanageable.

We spend a lot of time with the traversing of the rooms. At first we had the problem that the traversing program ended up in an infinite loop and finally crashed. After finding out that the rooms are actually a directed graph, we skipped the rooms that have already been visited. To realize this in prologue was more difficult than



expected.

In one of the linked URLs, our problem was explained in detail and we could implement it with their help.

The remaining functions were a lot easier to implement and fast realized. However, we have both noticed that this is not our favourite way to program and will probably make a big bow to Prologue in the future.