# Assignment 03 (Due: Saturday, December 7, 2013)

CSCE 322

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## 1 Instructions

This assignment will use Prolog to extract certain information about the *Pac-Man* map and the entities within the map.

### 1.1 Data File Specification

As in Assignment 02, the map will be represented as a list of lists. The atoms of the map and a sample map are presented in Table 1 and Figure 1.

| Atom | Meaning |
|---|---|
| b | Border Cell |
| w | Wall Cell |
| f | Food Cell |
| p | Power Pellet Cell |
| m | *Pac-Man* Cell |
| g | Ghost Cell |
| 6 | Ghost and Food Cell |
| r | Ghost and Power Pellet Cell |
| u | Empty Cell |

Table 1: Atoms in a *Pac-Man* Map

| | | | | |
|---|---|---|---|---|
| b | b | b | b | b |
| b | p | f | p | b |
| b | w | w | w | b |
| b | m | u | g | b |
| b | b | b | b | b |

Figure 1: A Sample *Pac-Man* Map (`sampleMap`)

### 1.2 `percentWalls(Map)`

The query `percentWalls(Map)` will be successful when the at least 10% of the map contains Wall cells. The map must be bounded as part of the query.
`percentWalls([[b,b,b,b,b],[b,p,w,p,b],[b,m,f,g,b],[b,u,w,w,b],[b,b,b,b,b]])` will be successful.
`percentWalls([[b,b,b,b,b],[b,p,f,p,b],[b,m,f,g,b],[b,u,w,u,b],[b,b,b,b,b]])` will be unsuccessful.
`percentWalls(sampleMap)` will be successful.

### 1.3 `pathOfGhost(Map,Path)`

The query `pathofGhost(Map,Path)` will be successful when `Path` is unified with the shortest valid path (fewest number of valid moves) from the position of the ghost, to the position of *Pac-Man* . It can be assumed that there is only one ghost in the map for this part. There may be multiple shortest paths, and `pathOfGhost(Map,Path)` should report them all, if `;` appears in the query.

The ghost cannot move through Border cells or Wall cells, and can only move vertically or horizontally. Step directions should be represented as `u,d,l,r` corresponding to up, down, left, and right.
`pathOfGhost(sampleMap,[l,l])` would be successful.
`pathOfGhost(sampleMap,[l,l])` would result in

```
Path = [l, l]
true ;
fail.
```

### 1.4 `makeMap(Map)`

The query `makeMap(Map)` will be successful when `Map` satisfies these properties:

1. At least 10% of the `Map` contains Wall cells
2. Border cells only appear on the edge of the `Map`, and the cells on the edge of the `Map` are only Border cells
3. Each of the 4 corners of the `Map` contains a Power Pellet cell (inside the Border cells)
4. The `Map` does not contain a food/space/ghost/power pellet cell (inside of the borders) that is unreachable by *Pac-Man* . An example of such a configuration is presented in Figure 2.

| | | | | |
|---|---|---|---|---|
| b | b | b | b | b |
| b | p | w | p | b |
| b | w | w | w | b |
| b | m | u | g | b |
| b | b | b | b | b |

Figure 2: An Invalid *Pac-Man* Map

You can only assume that the map shape is bounded.
`makeMap([[b,b,b,b,b],[b,p,w,p,b],[b,f,m,g,b],[b,p,w,p,b],[b,b,b,b,b]])` will be unsuccessful (2 walls out of 25 cells).
`makeMap([[b,b,b,b,b],[b,p,w,p,b],[b,w,m,g,b],[b,p,w,p,b],[b,b,b,b,b]])` will be unsuccessful (Lower-left Power Pellet cell is unreachable)).
`makeMap([[b,b,b,b,b,b,b],[b,p,w,w,w,p,b],[b,f,f,f,f,f,b],[b,m,u,Var,u,g,b],[b,f,f,f,f,f,b],[b,p,w,w,w,p,b],[b,b,b,b,b,b,b]])` will be successful with

```
Var = f
true ;
Var = u;
...
```

`makeMap([[V1,V2,V3,V4,V5,V6,V7],[b,p,w,w,w,p,b],[b,f,f,f,f,f,b],[b,m,u,u,u,g,b],[b,f,f,f,f,f,b],[b,p,w,w,w,p,b],[b,b,b,b,b,b,b]])` will be successful with

```
V1 = b
V2 = b
V3 = b
V4 = b
V5 = b
V6 = b
V7 = b
true;
fail.
```

`makeMap([[b,b,b,b,b,b,b],[b,p,w,w,w,p,b],[b,f,f,f,f,f,b],[b,m,u,Var,u,g,b],[b,f,f,f,f,f,b],[b,p,f,w,f,p,b],[b,b,b,b,b,b,b]])` will be successful with

```
Var = w
true;
fail.
```

### 1.5 README.txt

This file should contain any assumptions that you made and sources that you used during the completion of this assignment.

## 2 Compilation & Execution

Your program will be tested on `cse.unl.edu`, using `pl`. `testcases.pl` will include test cases for testing your program. You can run the test cases with the commands:

```
[testcases]
main01part01
```

from within `pl`. The number following `main` can be replaced with 02 . . . 05 and the number following `part` can be replaced with 02 or 03 to try different test cases. Entering a `;` will allow you to see every possible binding of results

## 3 Naming Conventions

You will be submitting 3 `.pl` files and 1 `README.txt` file. The filenames should be `csce322a3p1.pl`, `csce322a3p2.pl`, and `csce322a3p3.pl`

## 4 Point Allocation

| Component | Points |
|---|---|
| `csce322a3p1.pl` | 25 |
| `csce322a3p2.pl` | 35 |
| `csce322a3p3.pl` | 35 |
| `README.txt` | 5 |
| Total | 100 |

## 5 External Resources

Prolog - Wikibooks
Learn Prolog Now!
Prolog Tutorial