# Computer Science 5400
# Artificial Intelligence

Spring 2024

Puzzle Assignment Set : Act-Man II

version 24.02.23

## Introduccion

The puzzle for this semester is **Act-Man-II**, a turn-based game inspired by Gregory Yob's *Hunt the Wumpus* and Namco's famous 80's video game *Pac-Man*. The objective of the game is for the Act-Man to navigate a dungeon attempting to defeat a group of monsters that also move around the dungeon. Act-Man dies if it is caught by any of the monsters. The monsters come in two types: **Ogres** and **Demons**.

## The Dungeon

The dungeon is a grid board where every cell location is either a **wall** or open **space**. Act-Man and each monster occupies a single empty space. Corpses of dead monsters also occupy a single cell. Neither Act-Man nor the monsters nor the monster's corpses can occupy a cell with a wall.

A sample dungeon showing the Act-Man 🤠, some monsters ( 👹 😈 ), and a monster's corpse ( ☠️ )

## Act-Man

Act-Man can perform the following actions:

- Move to any directly adjacent empty spaces in one of the 8 basic cardinal directions. ( **north**, **northeast**, **east**, **southeast**. **south**, **southwest**, **west**, **northwest** ).
- Fire a magic bullet in any of the 4 orthogonal directions ( **north**, **south**, **east**, **west**. no diagonals ).
    - A magic bullet flies in a straight line, through any non-wall cell.
- Act-Man has only **one** magic bullet.

### Act-Man's Score

- Act-Man starts with 50 points.
- Act-Man loses one point every turn he moves.
- Act-Man loses 20 points in the turn he fires a magic bullet.
- Act-Man gains 5 points per monster that dies in a turn.
- Act-Man score is zero if he dies.

## The Game Turn

The game progresses by turns. Each turn involves a single action from both

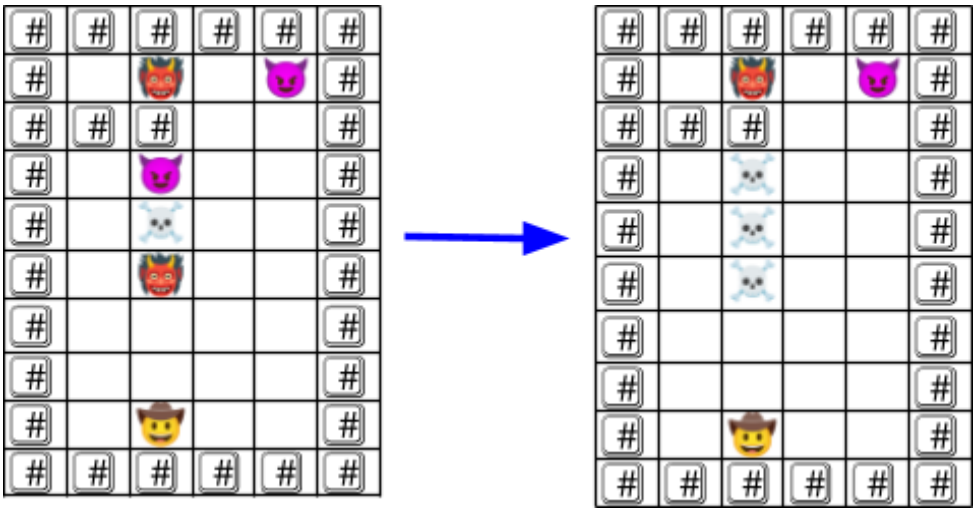
Act-man and the monsters. Each turn involves the following five stages:

1. Act-Man makes a move or fires a magic bullet.
    a. If Act-Man moves and then shares the same cell with a monster or a monster's **corpses**, the game ends.
    b. If Act-Man fires a magic bullet, any monsters in the path of the bullet **die** and their **corpses** now occupy their respective cells.
2. Each of the monsters makes a move.
3. If Act-Man and any of the monsters share the same cell, the game ends.
4. If more than one monster occupies the same cell, or a monster moves into a cell occupied by a monster's **corpses**, those monsters **die.**
5. If Act-Man's score is less than or equal to 0, the game ends.

Turns continue until the game ends during a turn, or the victory condition is achieved : All monsters are dead.

## The Magic Bullet

In a turn, instead of moving, Act-Man can fire a magic bullet. Act-Man can fire one magic bullet **per game**. Any monsters in the path of the bullet **die** and turn unto corpses. Bullets cannot go through walls.

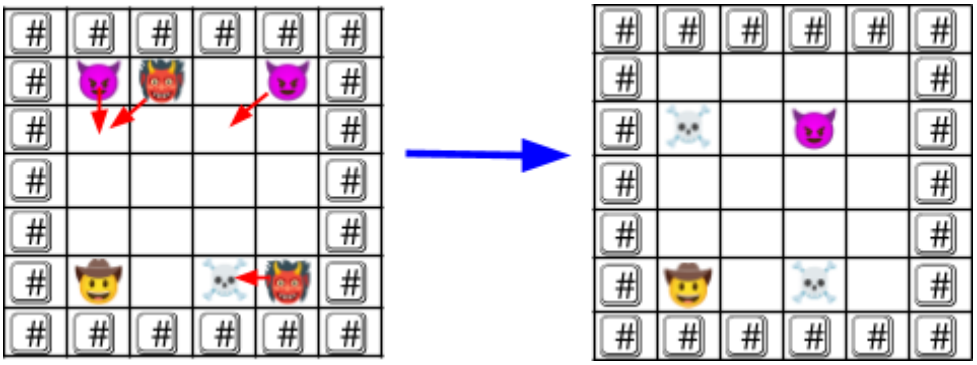


**Example**: Act-Man 🤠 fires a magic bullet **north**, one ogre ( 👹 ), and one demon (

😈 ) die. Note that the bullet flies through the corpse ( ☠️ ) but is stopped by a wall ( [#] )

## Monster Movement Rules

On step 2 of each turn, each of the monsters make a move to an open space adjacent to their current location in one of the 8 basic cardinal directions. ( **north**, **northeast**, **east**, **southeast**. **south**, **southwest**, **west**, **northwest** ).
Each monster attempts to *chase* Act-Man, but they follow specific rules to decide in which direction to move according to their type. Monsters always make a move in every turn.
When more than one monster finishes their turn in the same cell as another monster or a monster's corpse, they **die** and turn into a corpse.

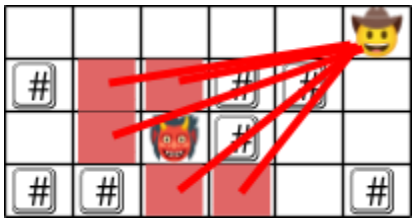


**Example**: Suppose each monster decides to move in the direction indicated by the red arrow. One ogre and one demon move into the same cell and **die**. Another ogre moves into a corpse and **dies**. One demon moves into an empty space and remains alive in the next turn.

## Monster Movement Rules

## Ogres

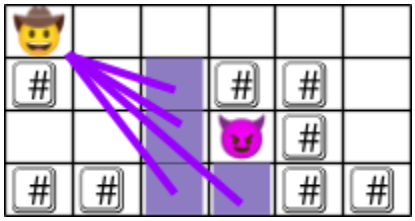
To choose a move an **ogre** compares the distance between each adjacent non-wall cell with the location of Act-Man. The ogre then chooses to move to the open space that is closer to Act-Man's location. If there is a tie, the ogre prefers the first move in the **clockwise order:** ( **north**, **northeast**, **east**, **southeast**. **south**, **southwest**, **west**, **northwest** )



**Example**: The ogre compares the distance between the cells and Act-Man's current location, and chooses to move to the one with the shortest distance: **North**.

## Demons

To choose a move a **demon** compares the distance between each adjacent non-wall space cell with the location of Act-Man. The demon then chooses to move to the open space that is closer to Act-Man's location. If there is a tie, the demon prefers the first move in the **counterclockwise order:** ( **north**, **northwest**, **west**, **southwest**. **south**, **southeast**, **east**, **northeast** )



**Example**: The demon compares the distance between the cells and Act-Man's current location, and chooses to move to the one with the shortest distance: **Northwest**.

# General Notes:

- Every dungeon is completely surrounded by walls.
- Monsters will always have at least one available move.
- Monsters compute the distance to Act-Man using linear euclidean distance,

ignoring walls.

$$\text{distance}^2 = (r_1 - r_2)^2 + (c_1 - c_2)^2$$