**CS440 – Constraint Satisfaction Problems**

Purpose: Pacman is trapped! He is surrounded by mysterious corridors, each of which leads to either a pit (P), a ghost (G), or an exit (E). In order to escape, he needs to figure out which corridors, if any, lead to an exit and freedom, rather than the certain doom of a pit or a ghost.

Getting Started: .

We will be using `constraint.jnlp` which you can either download from Canvas or run on phoenix at `~jillz/cs440/constraint.jnlp`. You will also need the file `Trapped_Pacman.xml`.

Here is Pacman's predicament:
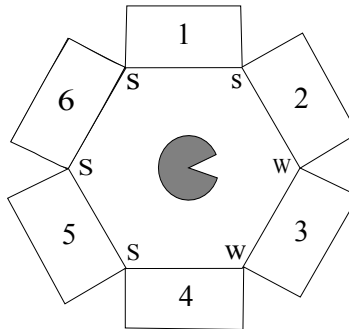
The one sign of what lies behind the corridors is the wind: a pit produces a strong breeze (S) and an exit produces a weak breeze (W), while a ghost doesn't produce any breeze at all. Unfortuantely, Pacman cannot measure the the strength of the breeze at a specific corridor. Instead, he can stand *between* two adjacent corridors and feel the max of the two breezes.

For example, if he stands between a pit and an exit he will sense a strong (S) breeze, while if he stands between an exit and a ghost, he will sense a weak (W) breeze. The measurements for all intersections are shown in the figure above.

Also, while the total number of exits might be zero, one, or more, Pacman knows that two neighboring squares will *not* both be exits.

Assignment 1 – Setting up the constraint graph

Open up the file `Trapped_Pacman` in the `constraint.jnlp` application. You will see that I have set up six variables for you representing the possible values behind each of the six doors.

Start by creating a binary constraint called "1S2 and 2E" between X_1 and X_2 which represents the information that Pacman feels a strong breeze between these two doors and that these doors can't both be exits. You will see that when you create a constraint you will be given check boxes for possible pairs of values between the two variables. You will need to check just the pairs that satisfy this constraint.

Now create the constraints "2W3 and 2E", "3W4 and 2E", etc. You will also need to create unary constraints for X_2, X_3, and X_4 which restrict the values of these variables. Hmm.. what do the breeze strengths near these doors tell us?

Criteria of Success: Once you have all your constraints you can use the Solve - Auto Arc-Consistency button to see the application apply consistency to all the arcs. There should be only one possible value for X_1 and X_5 and only two possible values of X_2, X_3, and X_4.

Assignment 2 – Getting a solution for this CSP

We don't have a solution yet for Pacman. According to MRV, which variable or variables could the solver assign first?

But Pacman finds a note on the floor. It reads "Beware – there is a ghost behind door 6". Put that information into your CSP graph by selecting a value for X_6 and solve again. Pacman now has two solutions for this problem (yes only two if you use all the information for this problem). What are the solutions and can Pacman find a safe way out? Why or why not?

Criteria of Success: You have given the two possible solutions for Pacman and have a written answer for the MRV question.

Save and submit your `Trapped_Pacman` constraint graph in Canvas for grading as well as your written answers.