Assignment 1 Report

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Brief Overview

Firstly, this assignment was not coded through the template code provided by the TA's. Therefore, there may be differences in implementations.

Basic Ideas

- To render a game screen divided into grid cells, I have used a "2D array approach" to store the information of the grids.
- JavaScript does not have an in-built feature for 2D arrays. We emulate them using an array of arrays.

```
const map1 = [
  ['0', '0', '0', '0', '0', '0', '0', '0', '0', '0'],
  ['0', 'g', '1', '1', '1', '1', '1', '1', '1', '0'],
  ['0', '1', '0', '0', '0', '1', '0', '0', '2', '0'],
  ['0', '1', '1', 'g', '1', '1', '0', '0', '1', '0'],
  ['0', '1', '0', '1', '0', '1', '1', 'g', '1', '0'],
  ['0', '1', '0', '1', '0', '1', '0', '0', '1', '0'],
  ['0', '1', '0', '2', '1', '1', '1', '1', '1', '0'],
  ['0', '1', '0', '1', '0', '0', '0', '0', '1', '0'],
  ['0', '1', '1', '1', 'p', '1', '1', 'g', '1', '0'],
  ['0', '0', '0', '0', '0', '0', '0', '0', '0', '0']
]
```

An example of a map implemented using 2D array.

- All positions of blocks, pellets and Pacman are defined by the map state, and rendered accordingly.

- I have used a projection matrix to shift and scale the canvas so that the top left corner corresponds to the origin and left and down correspond to positive x and y axes, respectively.
- All objects of the map use the same matrix for rendering, except Pacman who can be rotated. This is a distinguishing point because other objects are not affected by rotation.
    1. Map boundaries are rendered as blocks, so they are not affected by map rotations.
    2. Pellets and power pellets are rendered as squares too, so they are not affected by map rotations either.
    3. The ghosts, rendered as upwards pointing triangles, are explicitly mentioned to not be affected by map rotations. Therefore, none of the objects need to be rotated, other than Pacman.
- Finally, after all objects have been rendered once, the game only renders objects again when an event occurs, like a key being pressed. Changes are made to the map accordingly.

QnA

1. My map rotations are implemented as rotations of the map matrix (or 2D array). Therefore, the positions of all objects relative to each other are maintained between rotations. However, the orientation of objects might change. This is handled as follows:
    - For the ghosts, the orientation must stay the same between rotations. Therefore, by not applying any rotations to the transformation matrix, they can be kept at their respective orientations throughout map rotations.
    - For Pacman, whenever the map is rotated in any direction, a corresponding rotation matrix is multiplied with the transformation matrix. This preserves Pacman's orientation with respect to the map.
2. When rotating the map itself, I make changes to the map array and render the resulting map. No changes are made to the transformation matrix for the map. When rotating Pacman, I make the needed change in the transformation matrix (multiplying it by the rotation matrix of the needed angle), then rendering it. This process also needs to move Pacman to the origin first, rotating it there, then moving it back to the original position.
3. In my implementation of the game, I have tried to keep all processes independent of the scale. For example, if the map dimensions change, the object dimensions will change accordingly provided the canvas size remains the same, since the grid size is calculated from the current dimensions of the canvas and the map matrix.