Date: Feb 25, 2020

Student name: Hien Le

Student numner: 101044264

COMP 4106 - ASSIGNMENT 1 - REPORT

1. STATE SPACE

- Every state of the game includes:
  - **Size of the grid**: 2D array, indicating which direction the cat and the mouse can move.
  - **locations of the cheese**: a 2D of the cheese's coordinates - [[x1, y1], [x2, y2] . . .]
  - **location of the mouse**: an array of the x and y coordinates - [x, y]
  - **location of the cat**: an array of the x and y coordinates - [x, y]
- Initial state:
  - When the game starts, the cat, mouse, and cheese will be randomly
  - However, their locations are initialized in a way that there's no 2 objects placed at the same location
  - Size of the grid remains unchanged.
- Actions:
  - No action required to be done for the mouse, because its path is deterministic
  - Update the cheese: remove the cheese once the mouse passes by
  - Movements of the cat: each move the cat makes, the state will be updated
- Goal:
  - The goal is for the cat to catch the mouse before all of the cheese are eaten
  - In other words, (cat's location == mouse's location) **and** (number of cheese > 0)
- Path Cost:
  - Number of moves the cat needs to catch the mouse

2. HEURISTICS

- Distance between the cat and the mouse (*h1*):
  - This heuristic is measured in terms of the square of Ecludian distance between the cat and the mouse
  - $h = |x_{cat} - x_{mouse}|^2 + |y_{cat} - y_{mouse}|^2$
  - By applying the heuristic, the cat is basicially chasing and trying to get close to the mouse as soon as the game starts
  - Therefore, this requires fewer moves as well as fewer nodes to be search.

- Distance between the cat and last cheese (*h2*):
  - This heuristic is calculated based on the square of the distance between the cat and the last cheese
  - $h = |x_{cat} - x_{lastcheese}|^2 + |y_{cat} - y_{lastcheese}|^2$
  - In this heuristic, the cat is guarding and moving around last piece of cheese (or the final destination of the mouse) and waiting for the mouse to come
  - As a result, this requires more moves for the cat to make
- The average of the above heuristics
  - This heuristic is measured by taking the average of *h1* and *h2* -> $(h_1 + h_2)/2$
  - For this heuristic, the behaviour of the cat will be to move to the middle of the mouse and the last cheese, since it gives the smallest average
  - Since the grid is small, the cat will take almost the same number of moves as if using *h1*