PacMan – Memetix

Introduction

This document describes the PacMan entry into the WCCI 2012 PacMan vs Ghosts AI competition run by Essex University. It is written by Daryl Tose.

Design

The design for the PacMan was based on my winning Spooks entry in the previous competition, with improvements to the timing of Power Pill eating and edible ghost chasing.

The Spooks entry doesn't try to clear levels, it scores highly by running away (trying to survive as long as possible) and eating power pills when the ghosts are close by. This approach removes complexity from the solution as it can safely ignore the problem of trying to clear pills in an efficient manner.

A description of the Spooks entry can be found at www.blackmoor.org.uk/AI.htm.

Implementation

I toyed with using a Min/Max tree and improved the speed of my scoring heuristic by using breadth first searches, rather than recursive routines to work out the area the PacMan has safe access to. A node is classed as safe if the PacMan can get to it before any non-edible ghost. The nodes where the PacMan reaches a ghost are known as the event horizon.

In the end I abandoned the Min/Max tree as I was only able to reach a depth of 12 moves ahead on average and this was not enough to make the approach worthwhile. I found a slower but more robust scoring algorithm at depth 1 produced better results than a fast method at depth 20.

Each game tick every node is given a score according to how highly the PacMan values it. The PacMan then heads towards the node with the highest score. As the game state changes, the scores for different nodes change. The PacMan priorities also change over time.

The aim is to make the most of each Power Pill. The level time (3000 ticks) is divided by the number of Power Pills (4), the plan being to eat one Power Pill at the end of each quarter (750 ticks) leaving enough time to gobble up ghosts afterwards. A Power Pill will only be eaten if there are 4 ghosts in edible range, or we are forced to eat a Power Pill by an approaching ghost. If we reach 1500 ticks and still haven't eaten a power pill, then we drop the requirement down to 3 ghosts in range instead of 4.

Most of the time Power Pills have no score and are simply seen as walls (dead ends). While in this state, the highest scoring node in the maze will be the best "escape route". This is defined as the junction nearest the event horizon with the most ghosts nearby. The effect of this choice is to get as many ghosts as possible close to the PacMan. Some ghost teams will form a chain of ghosts following close behind the PacMan and these can be easily gobbled up when a Power Pill is finally

eaten. This code effectively makes the most of “weak” ghost implementations. Raising the average score from 80,000 to 160,000 points against these “weak” teams has far move effect than doubling your score against the “strong” ghost implementations where you score about 6000 points.

When there are edible ghosts available, the PacMan will head towards the nearest edible ghost within the event horizon.

If the PacMan has access to over 85% of the map and there are no edible ghosts to eat, then it switches to nearest pill eating mode. This doesn’t happen very often, but for some “weak” ghost teams that follow in a chain, it does allow the level to be cleared effectively and safely.

This was implemented with 660 lines of code.