Instructor and Teaching Assistant

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Artificial Intelligence for Games (2nd edition)
Ian Millington and John Funge

ISBN: 978-0123747310

ai4g.com
https://piazza.com/ucsc/fall2013/cmps146
Grading Rubric

First Project: 20% ⭕
Assignments: 15%
Final project: 25%
Midterm: 20%
Final: 20%
Academic Integrity Policy

Andrea Marutti, photopin, cc
http://www.flickr.com/photos/afeman/25477598/
Academic Integrity Policy

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DRC Accommodations

If you qualify for classroom accommodations because of a disability, please get an Accommodation Authorization from the Disability Resource Center (DRC) and submit it to the instructor in person outside of class (e.g., office hours) within the first two weeks of the quarter. Contact DRC at 459-2089 (voice), 459-4806 (TTY), or http://drc.ucsc.edu for more information on the requirements and/or process.
The TA is your first stop

Questions about grading?
1. Discuss with teaching assistant (Bryan).
2. Not satisfied? Send contact instructor (Josh) during office hours or via email.

General Questions or Clarifications?
1. Post on Piazza.
2. Ask in class.
Topics (in rough order)

Decision Trees
Finite State Machines
Path Planning
Steering
Behavior Trees
Goal-Oriented Action Planning
IDA*
Special Topics/Guest Lectures
Bryan Blackford

game-o-matic

http://game-o-matic.com/
Daniel Brown

Procedural Music Composition for Games

A

(PERIOD)

ANTECEDENT

PHRASE 1 (ant₁)

MEAS. 1 (ant₁)

&

PHRASE 2 (ant₂)

MEAS. 1 (ant₂)

Ab: V7/V

CONSEQUENT

PHRASE 1 (cons₁)

MEAS. 1 (cons₁)

&

PHRASE 2 (cons₂)

MEAS. 1 (cons₂)

Ab: V

I

V+

I

Guest Lectures

Craig Reynolds
Steering Behaviors

http://www.red3d.com/cwr/steer/
Upcoming talks

Inventing The Future of Games Lectures Series

- Fridays, 11:00 – 12:00, Simularium
- It’s a two unit seminar, but you can drop in as well
The Future

‘A Glimpse into the Future of television at Festival Hall’, 1960
Central Press Photos Ltd © National Media Museum
Bradford / SSPL. Creative Commons BY-NC-SA
What are current games good at?

- Realistic Graphics
- Physics Simulation
- Combat Systems
Design Barriers
Design Barriers
Design Barriers
Ideas on where to focus

“Can we please start working on non-combat A.I.? We spend all of our cycles in each new hardware generation to create graphics people expect. But how do we make characters act better?”

Warren Spector
Inventing the Future of Games 2013
AI and Perception
What is game AI?
What is game AI?

- **Tasks**
  - Pathfinding
  - Bot behavior (chasing, guarding…)
  - Reputation
  - Strategic reasoning
  - Group behavior
  - Learning
  - Etc.

- **Techniques**
  - A*
  - Rule systems
  - Neural networks
  - Artificial evolution
  - Planning
  - Finite state machines
  - Blobs of random code
  - Etc.
Game AI lies in perception

Player

Goals Beliefs Emotions

Game
Behavior = AI + physics
“AI” is not the same as visual representation

Visual depiction of agents (ghosts)
Can be read intentionally

Visual depiction of agents (invaders)
Can’t be read intentionally (only physics)
“AI” is not the same as complexity
Game AI: programming for interpretation

Player

Goals
Beliefs
Emotions

Game

Designer/programmer

Goals
Beliefs
Emotions
AI is a medium

Black and White, 2000
Peter Molyneux (Lionhead)

Aaron, 1971 -
Harold Cohen

The Senster, 1970
Edward Ihnatowicz
Pac Man AI

http://gameinternals.com/post/2072558330/understanding-pac-man-ghost-behavior
Pac Man AI

8x8 pixel grids

Only center of characters count.

http://gameinternals.com/post/2072558330/understanding-pac-man-ghost-behavior
Pac Man AI

Simplified grid

Decisions only at colored points.

http://gameinternals.com/post/2072558330/understanding-pac-man-ghost-behavior
Movement modes (waves)

- Three movement modes
  - Chase
  - Scatter (target squares outside corners)
  - Frightened (random choice at intersections)

- First level phase durations
  - Scatter for 7, chase for 20
  - Scatter for 7, chase for 20
  - Scatter for 5, chase for 20
  - Scatter for 5, switch to chase permanently
Designing for Player Stress

“To give the game some tension, I wanted the monsters to surround Pac Man at some stage of the game. But I felt it would be too stressful for a human being like Pac Man to be continually surrounded and hunted down. So I created the monsters’ invasions to come in waves. They’d attack and then they’d retreat. As time went by they would regroup, attack, and disperse again. It seemed more natural than having constant attack.”

Toru Iwatani, Pac-Man creator
Turn decisions given a target

- Ghosts not allowed to reverse directions
- Ghosts forced to reverse direction on change from chase to scatter
Scatter mode
### Personalities

<table>
<thead>
<tr>
<th>CHARACTER / NICKNAME</th>
<th>CHARACTER / NICKNAME</th>
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<tbody>
<tr>
<td>SHADOW</td>
<td>&quot;BLINKY&quot;</td>
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<tr>
<td>SPEEDY</td>
<td>&quot;PINKY&quot;</td>
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<tr>
<td>BASHFUL</td>
<td>&quot;INKY&quot;</td>
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<td>POKEY</td>
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<td>OIKAKE</td>
<td>&quot;AKABEI&quot;</td>
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<td>MACHIBUSE</td>
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<td>KIMAGURE</td>
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<td>OTOBOKU</td>
<td>&quot;GUZUTA&quot;</td>
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</table>
Red Ghost

- Depending on pellets remaining
  - Speed increases by 5% at fixed points
  - Scatter target changes to chase target
Pink Ghost

- Ambusher
- Targets ahead of Pac-Man
Blue Ghost

Whimsical

Pac-Man and Red ghost's positions.

2 tiles ahead then double Red's vector.
Orange Ghost
The AI Model

- Execution Management
- Group AI
  - Strategy
- Character AI
  - Decision Making
  - Movement
- Animation
- Physics
- Content Creation
- Scripting

World Interface