Game Artificial Intelligence
(CS 4731/7632)

Instructor: Stephen Lee-Urban

Teaching Assistant: Larry He

http://www.cc.gatech.edu/~surban6/2016-cs4731/

What's this all about?

- Industry standard approaches to employing "AI" in modern computer games

- Distinctions between Game AI as a discipline and standard AI as a discipline

- Go beyond industry standard Game AI to look at emerging techniques

About the rest

- Self[+]

- Teaching Philosophy

- Syllabus

- Course Trajectory & Structure
  - (see webpage)

Course Topics

- State of the industry (standard practice)
  - Movement and path planning
  - Decision making
  - Strategy
- Procedural Content generation
- Advanced topics (/Case studies)
  - Believable characters and storytelling
 - Game analytics

Prerequisites

- Intro to AI course

- Data structures

- Comfort with "no right answer"

Homework Assignments

- Custom game engine
- Homeworks progressively build on each other
- Concludes with an AI that can play a Multiplayer Online Battle Arena (MOBA)
- Approximately every 1-2 weeks
- First homework due next week

Assignments & Grading

- Homework sequence (65%):
  - 1   Grid navigation
  - 1.5 Path networks
  - 2   Path networks + Navigation meshes
  - 3   All pair shortest path
  - 4   A*
  - 5   Minion Agents
  - 6   Hero Agents
  - 7   SMB level generation
- Capstone Project (25%)
- Exam (10%)
- Participation and Quizzes (-10%)
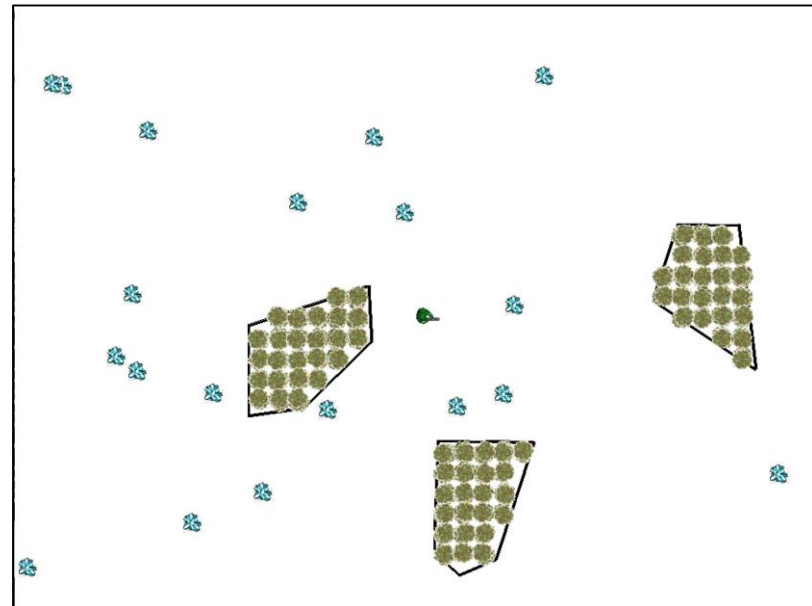
Optional Textbooks

- Millington and Funge, *Artificial Intelligence for Games*

- Buckland, *Programming Game AI by Example*
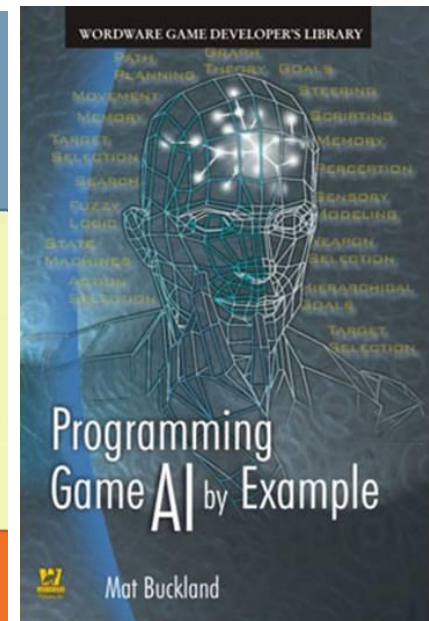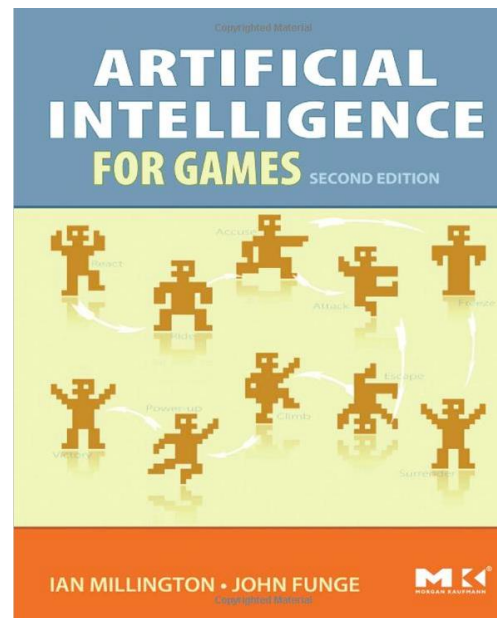
Artificial Intelligence

- Getting a computer to do something that a "reasonable person" would think requires intelligence

What this class is about

- AI **for** games
  - Ways in which AI can—and is used to—enhance game play experiences
  - Set of algorithms, representations, tools, and tricks that support the creation and management of real-time digital experiences
- In the game development industry, AI is the set of tricks and techniques to bring about a particular game design
- "Game AI is game design"

What this class is about

- How a game design can be brought into existence through the application of algorithms that are often thought of as intelligent

- About making the entities/opponents/agents/companions/etc. in games **appear** intelligent

- Not a substitute for an Intro to AI course

- Not going to teach good game design

What this class is NOT about

- AI **in** games
  - John Laird and Michael van Lent (2000): Games are perfect test-beds for "human level" AI
  - AI should play games as if human
    - Vision
    - Decision making in real-time
    - Handling uncertainty
    - Learning
    - Opponent modeling
  - Demonstrated with an AI agent that played Quake

Goals of AI

Systems that think like humans	Systems that think rationally
Systems that act like humans	Systems that act rationally

Goals of Game AI

- To support the player's experience in a game
- Note: this might mean doing simple AI, or things that academic researchers marginally consider AI

General roles of Game AI?

What is a game?

- A system of rules
- A goal

Types of games?

First Person Shooter

Real Time Strategy (RTS)
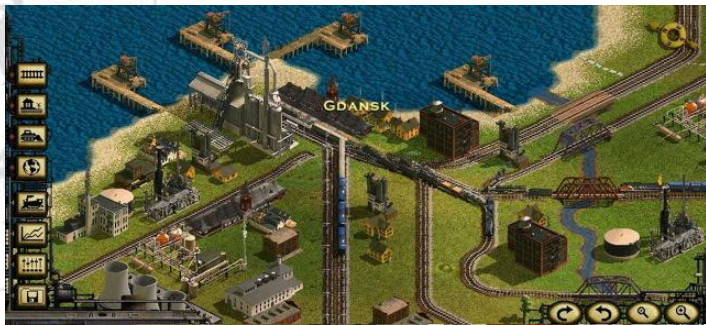
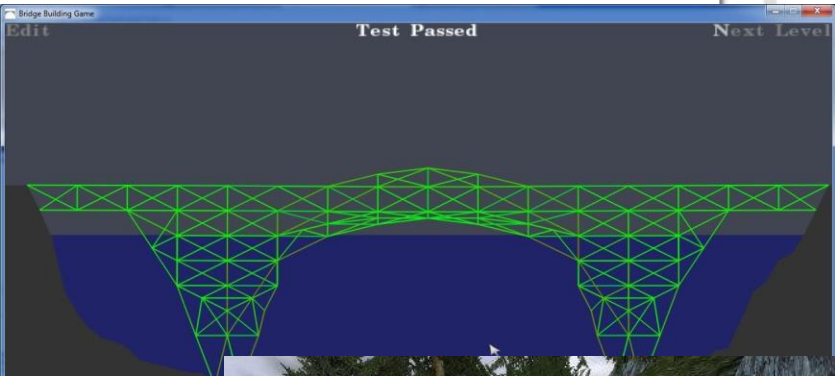# Role Playing Games (RPGs)

Platformer

God Games

Sports Games

Bridge Building Game

Time: 63
Weight: 40000

Wii

Nintendo

GDANSK

POS 3/6   SCORE 7105   LAP 2/3

TAKEDOWN! + 1000

133 mph ⏱ AT 5

Game 6
mbear (0 321 -1) vs

Find the missing number

1 + 6 = ?

17 16 18 6

SCORE:000100 ×2 ENERGY:

What brought you here?

Why AI in games?

- What is the "killer app" of games?
- Automation—because you need other people to do things, but don't always have those people
- Opponents
- Companions
- NPCs (shopkeepers, farmers, villains)
- Dungeon master?
- Plot writer?
- Game designer?

Goals of Game AI

- Kill you good
- Make non-player characters (NPCs)—opponents, companions, etc.—look convincing
  - Believable characters
- Make game more enjoyable
- Play like a human

Why distinct from "academic AI"?

- Resource limits
- Complexity fallacy ([G.O.L.](#))
- Fun vs. smart: goal is not always to beat the player
- Optimal/rational is rarely the right thing to do

Common "AI" Tricks

- Move before firing – no cheap shots
- Be visible
- Have horrible aim (being Rambo is fun)
- Miss the first time
- Warn the player
- Attack "kung fu" style (Fist of Fury; BL vs School)
- Tell the player what you are doing (especially companions)
- React to own mistakes
- Pull back at the last minute
- Intentional vulnerabilities or predictable patterns

Half-life: Freemans' Marine Encounter

- Do they attack Kung-Fu style?

Half-Life Kung-Fu Attack
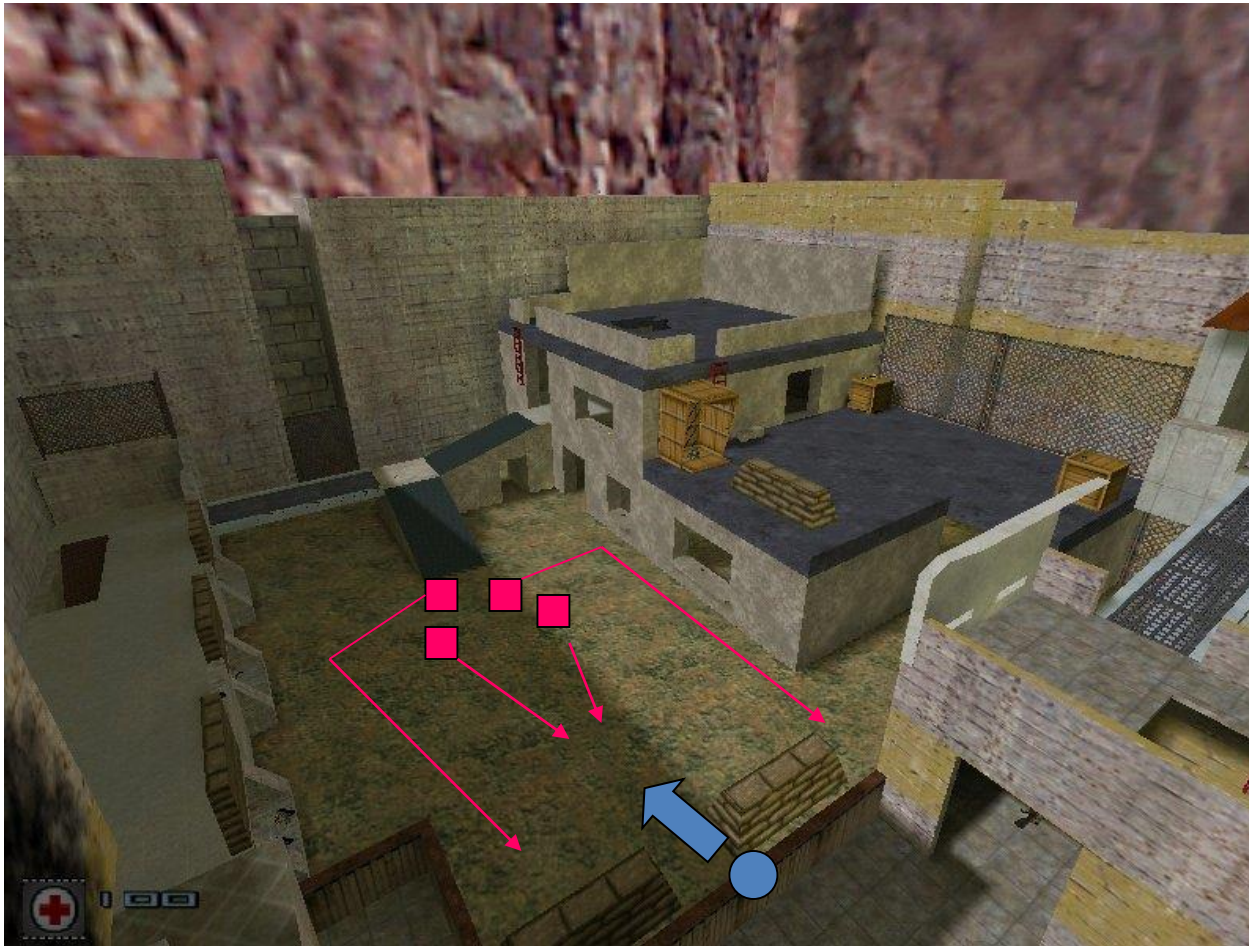
- Actually no more than 2 marines are attacking at any time

- The other marines take cover, move around etc.

- When one of the attacking marines run out of ammo, is wounded, dies, etc., one of the others take his place

- Some reactions are hard-coded and scenario-dependent

Common AI techniques

- Path planning, obstacle avoidance
- Decision making
  - Finite state machines
  - Trigger systems
  - Behavior trees
  - Robotics architectures
- Scripting
- Command hierarchies—strategic, tactical, individual combat
- Emergent behavior—flocking, crowds
- Formations
- Smart environments
- Terrain analysis—finding resource, ambush points
- Dynamic difficulty adjustment

Cheating

Intelligent vs. random