CSCI3230
Review Session

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Chapter 1: Introduction

- Course Structure
- What is AI?
- Why study AI?
- History of AI

Chapter 2: Intelligent Agents

- Percepts
- Actions
- Goals
- Environment
  - Properties of Environments

Chapter 3: Problem Solving By Searching

- Search Algorithms

characteristic, when to use,

  - Breadth-first search
    - Expand always the shallowest unexpanded node
    - Step costs are equal
  - Uniform-cost search
    - Expand always the shallowest unexpanded node with the lowest cost from the root
    - Step costs are not equal
  - Depth-first search
    - Expand always the deepest unexpanded node
  - Depth-limited search
    - Depth-first search with depth limit
  - Iterative deepening search
    - Iterative depth-limited search with increasing limit

Evaluation Criteria for Search Strategies

Criterion	Meaning
Complete	Does the algorithm always find a solution if one exists?
Time	Number of nodes expanded
Space	Maximum number of nodes in memory
Optimality	Does it always find the least-cost solution?

- Problem Formulation Practice:
  - Written Assignment 1: Q2

Chapter 4: Informed Search Algorithms

- Search Algorithms on Path
  - Best-first search
    - Expand the node with the best f(n), an evaluation function of the node
  - Greedy best-first search
    - h(n), an heuristic function estimating the cost from n to the goal
    - Expand the node with the best f(n) = h(n)
  - A* search
    - g(n), an function computing the cost from the start node to node n
    - Expand the node with the best f(n) = g(n) + h(n)
    - A* is optimal if h(n) is an **admissible** heuristic, that is h(n) never overestimates the cost to reach the goal
- Practice:
  - Written Assignment 2: Q1b

之前只有cost無knowledge

f(n) = g(n) —> same as before

mix g(n) and h(n)

唔會估過龍先得，depends on problem domain

need to prove A* is work

Chapter 4: Informed Search

- Search Algorithms on Optimization problems
  - Hill-climbing 計slope
  - Simulated annealing 可以escape from local optimum, 可以向前再走，但唔會向下試
  - Genetic Algorithms 有好多個points一齊爬山
- Algorithm Property 或然的
  - Deterministic / Stochastic?
  - Single Point / Multi-point?

Chapter 5: Game Playing

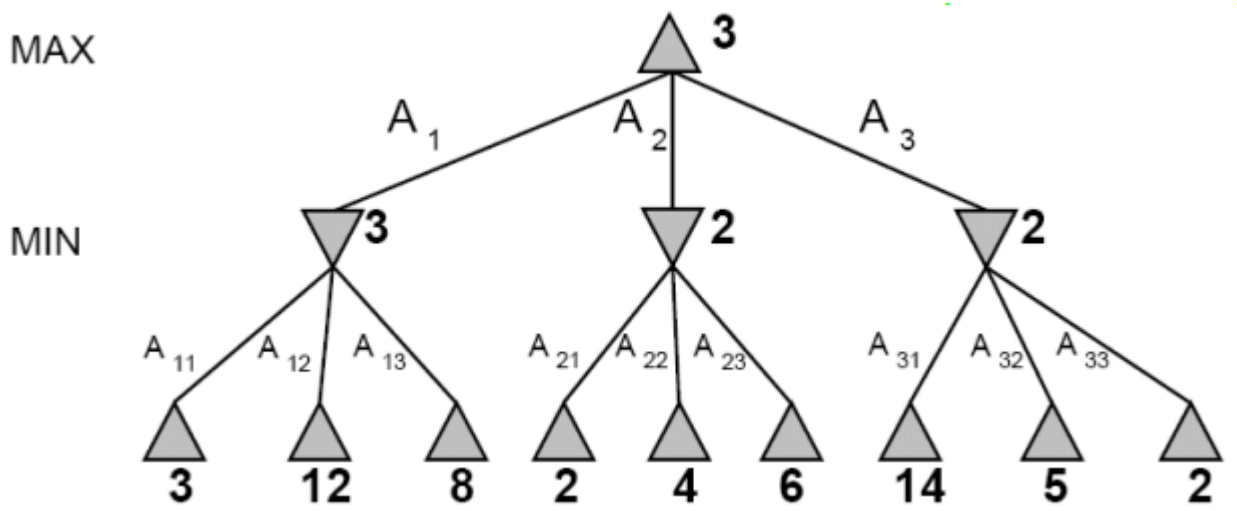
- Perfect information
  - Perfect information describes the situation when a player has available the same information to determine all of the possible games (all combinations of legal moves) as would be available at the end of the game.
  - Games with perfect information: Chess, Tic Tac Toe
  - Games with imperfect information: Card games
- Horizon problem
  - Search depth is often limited in practice
  - One falls victim to the problem when a significant change is slightly beyond the "horizon"
- Quiescence search
  - Quiescence positions are unlikely to exhibit wild swings in value in near feature. When we stop the depth-limited search, we apply quiescence search until quiescent positions are reached.

知道對手的內容

停在某個位，which is important
solution: 用另一方法評估，如果重要則做 quiesence search

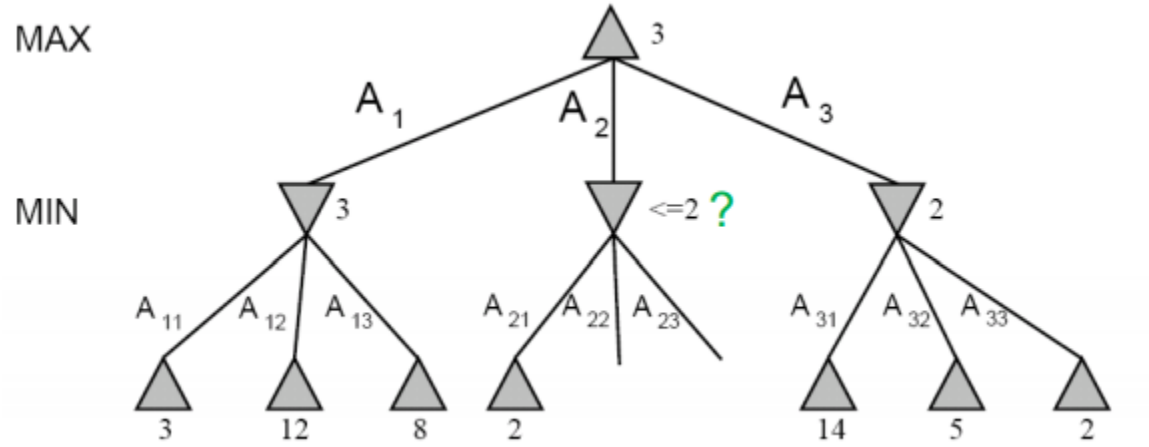
Chapter 5: Game Playing

- Mini-max Algorithm



Chapter 5: Game Playing

- Alpha-Beta Pruning



  - Practice:
    - Written Assignment 2: Q1b

Chapter 7: Logical Agents

- Propositional logic
- CNF, DNF, Horn clauses
- Forward chaining
- Backward chaining
- Resolution prove by contradiction
- Similarities / Differences

Properties

Syntax
Semantics
Entailment
Inference
Soundness
Completeness

Chapter 8: First Order Logic

- What is First-order logic?
- What is Higher-order logic?
- What are differences between prepositional logic, first-order logic and higher-order logic?

difference btw FOL & HOL

Chapter 9: Inference in First-Order Logic

- Inference
  - Unification
  - Forward chaining
  - Backward chaining
  - Resolution
- Conversion to CNF
  - How?
- Practice:
  - Written Assignment 3: Q1b

prolog

Tutorial: Data Mining

- What is Data Mining?
- Why Data Mining?
- Data Preprocessing
- Supervised Learning, Classification
- Confusion matrix (TP, TN, FP, FN)
- Accuracy, Recall, Precision, F-measure
- Under-fitting, Over-fitting, Cross-validation, Ockham's Razor

Chapter 20: Learning in Neural Networks

- Single Layer Perceptron (What is its limitation?)
- Multilayer Feed-forward Network (Neural Network)
- Activation function
  - Step function > 某個數就fire
  - Sigmoid function
  - Similarities / Differences
- Back-propagation learning
  - Gradient descent search
  - Learning rate
  - Mathematical Proof

with hidden layer

- Practice:
  - Written Assignment 3: Q2

Chapter 18: Learning from Examples

- Decision Tree
- Information Theory
  - Information content
  - Information gain
- Decision tree
  - Learn a decision tree
  - Evaluate a decision tree

$$I(V) = \sum_{i=1}^{n} -P_i log_2(P_i)$$

- Practice:
  - Written Assignment 3: Q1a

Deadline

- The deadline of Written Assignment 3 is 2nd Dec, 2013 (Monday) 23:59:59 (GMT +8:00)

- The deadline of Neural Network Project is 10th Dec, 2013 (Tuesday) 23:59:59 (GMT +8:00)

Examination

- Answer 4 out of 5 questions
- Each question consists of 25 marks

- Please bring HKEAA approved calculators

- Past Exam Paper is Available in CUHK Library
  - http://library.cuhk.edu.hk:81/
- Course Code
  - CSCI3230
  - CSC3230

END

Good luck to your Final Examination !