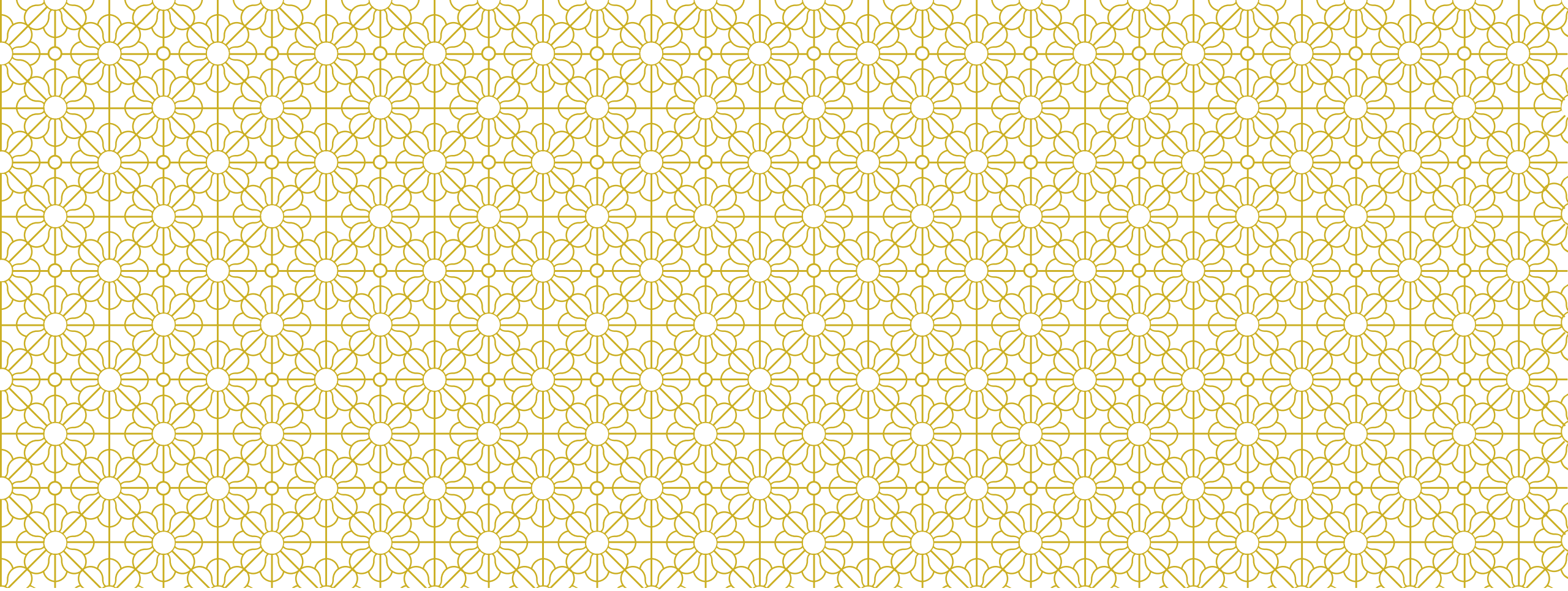


REVISION-FIRST PART FUNDAMENTALS OF AI(COMP1037)

Dr Qian Zhang

Spring 2023

SET / SEM

Target completion rate 50%

https://bluecastle-cn-surveys.nottingham.ac.uk

Strongly Agree = >

Neutral = >

Strongly Disagree = >

EXAM PAPER FORMAT

- **75%** Examination, 25% Coursework
- **3** Questions, each worth 25 marks
- Exam duration **1.5 hours**
- **Knowledge & Comprehension & Application**
- **Lab content will not be included (NO CODE)**

PAST PAPER

- Two past papers on Moodle page (2014, 2017)
- Similar Format
- Solution won't be provided!!!!

The University of Nottingham Ningbo China

SCHOOL OF COMPUTER SCIENCE

A LEVEL 1 MODULE, SPRING SEMESTER 2017-2018

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

Time allowed: Ninety (90) Minutes (1.5 Hours)

Candidates may complete the front cover of their answer book and sign their desk card but must NOT write anything else until the start of the examination period is announced

Answer All THREE questions

Total marks: 75. Each of the three questions contributes to 25 marks

Only silent, self-contained calculators with a Single-Line Display or Dual-Line Display are permitted in this examination.

Dictionaries are not allowed with one exception. Those whose first language is not English may use a standard translation dictionary to translate between that language and English provided that neither language is the subject of this examination. Subject specific translation dictionaries are not permitted.

No electronic devices capable of storing and retrieving text, including electronic dictionaries, may be used.

DO NOT turn examination paper over until instructed to do so

INFORMATION FOR INVIGILATORS:
Collect both the exam papers and the answer booklets at the end of the exam.

WHAT TO TEST

- Knowledge/ Comprehension/ Application
- AI basics and problem formulation
- Search (uninformed, informed)
- Game Playing

AI BASICS

- History of AI, definition of AI
- Strong AI /Weak AI
- Turing Test & Chinese Room
- Basics in machine learning

EXAMPLE QUESTIONS

[Comprehension] Briefly describe the Turing test and its objectives. Provide an example of a Turing Test in real life. Criticize Turing test by providing an example of objection. [7 Marks]

[Knowledge] In data mining, what are the relationships and difference between clustering and classification? [5 Marks]

PROBLEM FOMULATION & SEARCH TREE

- State Space
- Manage a search tree to define a search problem
- Evaluation criteria (Completeness, Time Complexity, Space Complexity, Optimality)
- BFS, DFS, UCS, Greedy Search, A* Search
- Heuristic function, Admissible, Informedness, Effective Branching Factor

EXAMPLE QUESTIONS

[Knowledge and Comprehension] What does admissible mean? Why is it important that the heuristic used be admissible? How to evaluate two heuristic functions if both of them are admissible? [5 Marks]

[Comprehension and Application] Given the layout of 17 sticks shown in the figure, you are required to remove exactly 5 sticks in such a way that the remaining configuration forms exactly 3 squares. Given two different operators as shown below, calculate the corresponding size of the state space. [4 Marks]

Operator A: remove five sticks at a time.

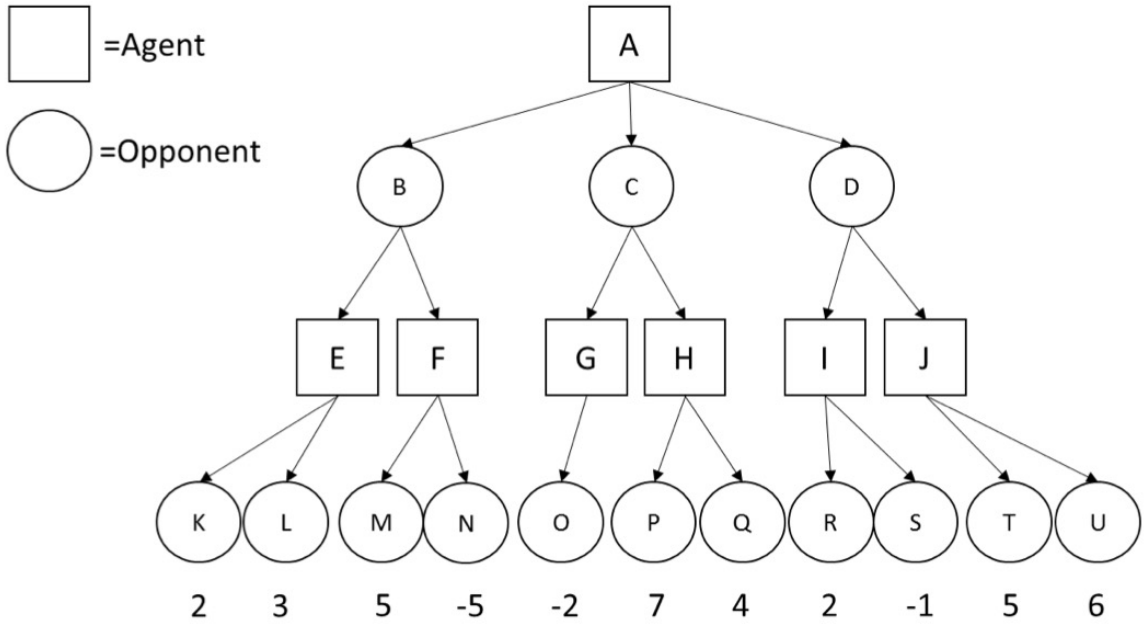
Operator B: remove three squares at a time.

GAME PLAY

- Components of Game Search
- How is a game represented as a search problem?
- Minimax Algorithm
- Alpha-beta Pruning

EXAMPLE QUESTIONS

[Application] Given the following search tree, apply the alpha-beta pruning algorithm to it and show the search tree that would be built by this algorithm. Make sure that you show where the alpha and beta cuts are applied and which parts of the search tree are pruned as a result. Explain why the alpha and beta cuts occur. [8 Marks]



GOOD LUCK !!!!!!

Revision
Fundamentals of AI (AE1FAI)

Slides created by Dr Huan Jin

OUTLINE

- **Machine learning**
  - Markov Decision Process(MDP)
  - Supervised learning (Classification)
  - Unsupervised learning (Clustering)

MARKOV DECISION PROCESS (MDP)

S:A MDP is defined by a tuple (*S,A, T, R*):

a set of states

A: a set of actions

T: a transition function,

- $T(s, a, s')$ where s ∈ S, a ∈ A, s' ∈ S, sometimes denoted as $P(s'|s, a)$

R: a reward function,

- $R(s, a, s')$ is reward for the transition (s, a, s')
- $R(s)$ is the reward for the state s

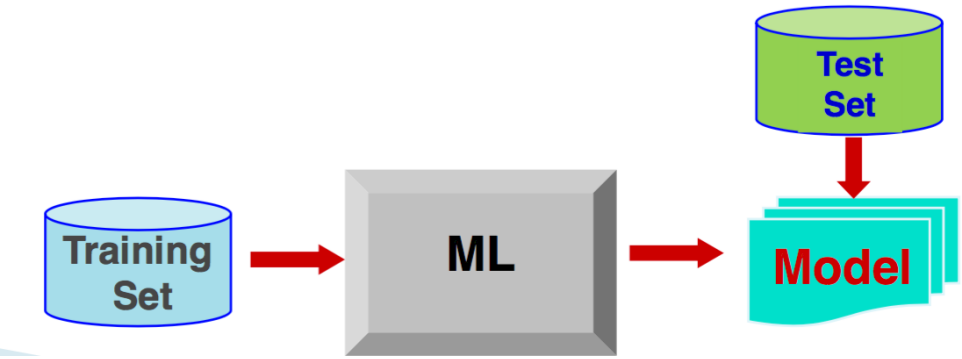
MARKOV DECISION PROCESS (MDP)

- Policy
- Policy evaluation
- Value iteration
- Optimal value and optimal Policy

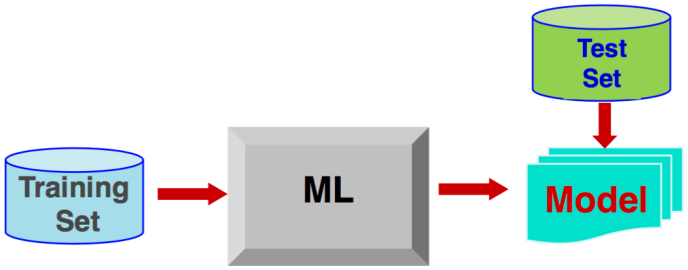
MACHINE LEARNING: PROCESS

Partition the total dataset into subsets:
Training set: Learning the parameters of the model

Test set: How the results will generalize to an independent (novel) data set



CLASSIFICATION
(SUPERVISED LEARNING)



- Data: a collection of records
  - Each record contains a set of attributes
  - One of the attributes is the class attribute
- Find a model for class attribute as a function of the other attributes
- Goal: assign a class to unseen records correctly
- Process
  - Divide the given data set into training & test sets
  - Use training set to build the model
  - y test set to validate the model

CLASSIFICATION: METHODS

- **Regression/Linear Learner**: (linear or any other polynomial)

  $a*x_1 + b*x_2 + c = y$

- **Neural networks**: partition by non-linear boundaries

- **KNN**

- **Naive Bayes**
  - **Bayes theorem, probability theory**

MACHINE LEARNING TASKS: UNSUPERVISED LEARNING

- **Unsupervised learning**: given only samples x of the data, infers a function f such that y = f(x) describes the hidden structure of the unlabeled data - more of an exploratory/descriptive data analysis
  - – Clustering: y is discrete. Learn any intrinsic structure that is present in the data

CLUSTERING: METHODS

- Partitioning-based clustering
  - **K-means clustering**

- Density-based clustering
  - Separate regions of dense points by sparser regions of relatively low density

LINK TO AI METHOD

Linear Programming, Integer Programming

Heuristic Algorithm

Metaheuristics(Genetic algorithm, Simulated annealing, Tabu search)

Population Based Metaheuristics

Hyper heuristic(Reinforcement learning)