

# WRAPPING UP

# Exam

- ◇ Worth 70 marks: 7 questions, 10 marks each
- ◇ 3 hours, 30 mark hurdle, will be run in Gradescope and accessible via the subject LMS
- ◇ Open book, but no consultation with others
- ◇ 2 – 3 sentences sufficient for when **brief** descriptive answer requested
- ◇ Detailed exam instructions, consultation times, and a practice exam with solutions should be available in the next week
- ◇ Solutions for tutorial questions from later weeks will be available soon
- ◇ Feedback quiz is another source of example questions
- ◇ Roughly half of subject on "symbolic" AI, and half on "probabilistic" AI
- ◇ Here are some examples of the types of skills required (not exhaustive)

# Week 1: What is AI? Intelligent Agents

- ◇ Explain different approaches to defining AI
- ◇ Describe the operation of the Turing test
- ◇ Characterise the difficulty of different common tasks
- ◇ Characterise requirements for an agent in terms of its percepts, actions, environment and performance measure
- ◇ Choose and justify choice of agent type for a given problem
- ◇ Characterise the environment for a given problem

## Week 2: Problem Solving and Search

- ◇ Formulate single-state search problem
- ◇ Apply a search strategy to solve problem
- ◇ Analyse complexity of a search strategy

## Week 3: Informed Search Algorithms

- ◇ Demonstrate operation of search algorithms
- ◇ Discuss and evaluate the properties of search algorithms
  - don't forget about iterative improvement algorithms
- ◇ Derive and compare heuristics for a problem
  - e.g., is a given heuristic  $h_1$  admissible;
  - for given heuristics  $h_1$  and  $h_2$ , does  $h_1$  dominate  $h_2$

## Week 4: Game Playing and Adversarial Search

- ◇ Demonstrate operation of game search algorithms  
e.g., which nodes will be pruned under given node order  
or optimal node ordering in a given search tree
- ◇ Discuss and evaluate the properties of game search algorithms
- ◇ Design suitable evaluation functions for a game
- ◇ Explain how to search in nondeterministic games  
e.g., demonstrate operation of ExpectiMinimax

## Week 5: Machine Learning in Game Search

- ◇ Discuss opportunities for learning in game playing
- ◇ Explain differences between supervised and temporal difference learning
- ◇ Not expected to derive or memorise the  $\text{TDLeaf}(\lambda)$  weight update rule, but if given this rule may ask you to explain what the main terms mean

## Week 6: Constraint Satisfaction Problems

- ◇ Model a given problem as a CSP
- ◇ Demonstrate operation of CSP search algorithms
  - e.g., in what order are variables or values chosen using
    - minimum remaining values, degree heuristic, least constraining value
  - e.g., show how the domain of values of each variable
    - are updated by forward checking, or arc consistency,
    - where  $X \rightarrow Y$  means using arc consistency to update domain of  $X$
    - so that for every value  $x \in X$  there is some allowed value  $y \in Y$
- ◇ Discuss and evaluate the properties of different constraint satisfaction techniques



## Week 7: Guest Lecture

◇ No examinable material

## Week 8: Uncertainty

- ◇ Calculate conditional probabilities using inference by enumeration
- ◇ Use conditional independence to simplify probability calculations
- ◇ Use Bayes' rule for solving diagnostic problems
- ◇ Note: if the arithmetic is too complex to compute the exact final value then simplify the expression as best you can

## Week 9: Bayesian Networks

- ◇ Formulate a belief network for a given problem domain
- ◇ Derive expression for joint probability distribution for given belief network
- ◇ Use inference by enumeration to answer a query about simple or conjunctive queries on a given belief network

## Week 10: Making Complex Decisions

- ◇ Compare and contrast different types of auctions
- ◇ Describe the properties of a given type of auction
- ◇ Select the most appropriate type of auction for a given application

## Week 11: Robotics

- ◇ Determine the number of degrees of freedom of a robot, and whether it is holonomic
- ◇ Characterise sources of uncertainty in a robot application scenario
- ◇ Explain the basic concepts of localisation and mapping
- ◇ Formulate an application problem using incremental Bayes, and calculate posterior probabilities
- ◇ Model the configuration space for a simple robot
- ◇ Compare different approaches to motion planning given a particular configuration space

## Week 12: Future of AI

◇ No examinable material

# Exam

◇ Would you like to see the exam...

# Wrapping Up

- ◇ I hope you enjoyed this introduction to AI
- ◇ Maybe we'll see you in the Master's level subjects
- ◇ Thank you for your patient attention
- ◇ Stay safe! Good luck with your exams and future studies