SWINBURNE UNIVERSITY OF TECHNOLOGY

COS30019: Introduction to Artificial Intelligence

Unit Review &

Exam Revision

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Announcements

- **Final Exam**:
  - When: Friday 9th June 2023, 9am-12pm (**you must submit to Canvas by 12pm, 9th June 2023 AEST**)
  - Available on Canvas
  - **Cover only the contents between Weeks 6-11**.
- Assignment 2
  - **You need to form team (even for 1-student teams)**
  - Due on **Friday 26 May 2023** (**4:30pm**)
  - **Submitted to ESP**
- Your Unit. Your say. Survey
  - On Canvas
  - Please provide constructive feedback

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AI/Definitions/Paradigms

- Define AI:
  - Different definitions
  - Can you briefly explain?
  - Can you compare between different AI paradigms?

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Intelligent Agents

- IA = AI systems that act rationally
- What does rationality mean?
- Performance measure?
- PEAS
- Task environment analysis?
- Agent structures?
  - Basic ones?
  - Advanced ones?

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Search-based problem solving agents

- Problem formulation?
- Search methods:
  - Uninformed/Blind
  - Informed/Heuristic
- Given a search problem, can you tell how different search methods will behave?
  - Make sure that you pay attention to Repeated State Check (RSC).

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Adversarial search/AI game playing

- Game tree
- Minimax
- Alpha-Beta pruning
- Expectiminimax

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The following slides are relevant to the Final Exam

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Knowledge-based agents

- Entailment (KB |= q)
- Models
- **Truth table**
  - **Can you use it to show entailment???**
- **Validity/Satisfiability/Unsatisfiability**
- Forward chaining
- Backward chaining

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Knowledge-based agents: FOL

- Quantifiers
- Models
- **Expressing logical sentences using FOL:**
  - **Can you converts English sentences to FOL???**

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AI Planning

- Planning languages?
  - STRIPS, ADL, PDDL???
- **Formulate a planning problem (initial state, goals, action descriptions)**
- State-space search
  - Progression planning
  - Regression planning
- Plan-space search
  - Partial Order Planning (POP)
- **Can you use an AI planning technique to manually find a plan for a planning problem?**

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Probability/Reasoning with Uncertainty

- The problem of reasoning with uncertainty
- Probability from first principles
  - Basic axioms
  - Definitions (e.g., **conditional probability**, Independence, conditional independence, etc.)
  - Conditioning
- **Bayes rule**
  - **Can you use Bayes rule to perform inference with probability?**
  - **Can you answer questions from the tutorials/Practice Exam?**

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Probability - Key concepts

- Prior probability, e.g. $P(A_{90}) = 0.92$
- Conditional probability, e.g. $P(A_{90}|\text{accident on freeway}) = 0.74$
- $P(a) + P(\neg a) = 1$
- $P(a \mid b) + P(\neg a \mid b) = 1$
- Definition of Conditional Probability:

$$P(A \mid B) = P(A \wedge B)/P(B) = P(B \mid A)*P(A)/P(B)$$

- Conditioning:

$$P(A) = P(A \wedge B) + P(A \wedge \neg B) = P(A|B) * P(B) + P(A \mid \neg B) * P(\neg B)$$

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Probability - Key concepts

- Causal reasoning (using Bayes' rule):
  - Diagnostic reasoning from causal probability:
  - ***P(Cause | Effect) = (P(Effect | Cause) * P(Cause)) / P(Effect)***
- Examples:
  - Cause: Cavity / Effects: Xray, toothache
  - Cause: Disease / Effects: Symptoms (fevers, sore throat), test positive
  - Cause: Faulty alternator / Effects: Car won't start or frequently stalled
  - Cause: Bad credit applicant / Effects: AI system at the bank raises a warning on the application

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Machine Learning - Key concepts

- "**Learning Problem**: A computer program is said to learn from experience E with respect to some task T and some performance measure P, if its performance on T, as measured by P, improves with experience E." - Tom Mitchell (1998)
- **Types of learning**:
  - Supervised (inductive) learning
  - Unsupervised learning
  - Semi-supervised learning
  - Reinforcement learning

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Machine Learning - Key concepts

- **Supervised learning with Linear Regression**:
  - A statistical regression method used for predictive analysis
  - Computing the best-fit line: $y = h_\beta(x) = \beta_0 + \beta_1 x$
  - Cost function (to measure the errors of the hypothesis h_β), e.g. MSE
  - Gradient descent – for optimization
  - Reinforcement learning
- **Design a learning systems**:
  - A ML algorithm consisting of 3 major components: **Representation**, **Optimization**, and **Evaluation**

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