# CS343 Artificial Intelligence

**Prof: Peter Stone** 

Department of Computer Science The University of Texas at Austin

#### **Good Afternoon, Colleagues**



#### **Good Afternoon, Colleagues**

Are there any questions?





• Tournament qualification underway



- Tournament qualification underway
- Tracking assignment due in two days
- Classification assignment to be assigned on Thursday



First weeks: search (BFS, A\*, minimax, alpha-beta)
Find an optimal plan (or solution)



- First weeks: search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions



- First weeks: search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step



- First weeks: search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - Know current state



- First weeks: search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - Know current state
- Next: MDPs —



- First weeks: search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - Know current state
- Next: MDPs towards reinforcement learning



- First weeks: search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - Know current state
- Next: MDPs towards reinforcement learning
  - Still know transition and reward function



- First weeks: search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - Know current state
- Next: MDPs towards reinforcement learning
  - Still know transition and reward function
  - Looking for a **policy** optimal action from every state



- First weeks: search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - Know current state
- Next: MDPs towards reinforcement learning
  - Still know transition and reward function
  - Looking for a **policy** optimal action from every state
- Before Midterm: Reinforcement learning



- First weeks: search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - Know current state
- Next: MDPs towards reinforcement learning
  - Still know transition and reward function
  - Looking for a **policy** optimal action from every state
- Before Midterm: Reinforcement learning
  - Policy without knowing transition or reward functions



- First weeks: search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - Know current state
- Next: MDPs towards reinforcement learning
  - Still know transition and reward function
  - Looking for a **policy** optimal action from every state
- Before Midterm: Reinforcement learning
  - Policy without knowing transition or reward functions
  - Still know state



- Probabilistic Reasoning: Now state is unknown
- Bayesian networks state estimation/inference



- Probabilistic Reasoning: Now state is unknown
- Bayesian networks state estimation/inference
- Prior, net structure, and CPT's known



- Probabilistic Reasoning: Now state is unknown
- Bayesian networks state estimation/inference
- Prior, net structure, and CPT's known
  - Week 5: Probability and utilities



- Probabilistic Reasoning: Now state is unknown
- Bayesian networks state estimation/inference
- Prior, net structure, and CPT's known
  - Week 5: Probability and utilities
  - Week 9: Conditional independence and inference (exact and approximate)



- Probabilistic Reasoning: Now state is unknown
- Bayesian networks state estimation/inference
- Prior, net structure, and CPT's known
  - Week 5: Probability and utilities
  - Week 9: Conditional independence and inference (exact and approximate)
  - Week 10: Exact state estimation over time



- Probabilistic Reasoning: Now state is unknown
- Bayesian networks state estimation/inference
- Prior, net structure, and CPT's known
  - Week 5: Probability and utilities
  - Week 9: Conditional independence and inference (exact and approximate)
  - Week 10: Exact state estimation over time
  - Week 11: Approximate state estimation over time



- Probabilistic Reasoning: Now state is unknown
- Bayesian networks state estimation/inference
- Prior, net structure, and CPT's known
  - Week 5: Probability and utilities
  - Week 9: Conditional independence and inference (exact and approximate)
  - Week 10: Exact state estimation over time
  - Week 11: Approximate state estimation over time
- This week: What if they're not known?



- Probabilistic Reasoning: Now state is unknown
- Bayesian networks state estimation/inference
- Prior, net structure, and CPT's known
  - Week 5: Probability and utilities
  - Week 9: Conditional independence and inference (exact and approximate)
  - Week 10: Exact state estimation over time
  - Week 11: Approximate state estimation over time
- **This week:** What if they're not known?
  - Also Bayesian networks for **classification**



- Probabilistic Reasoning: Now state is unknown
- Bayesian networks state estimation/inference
- Prior, net structure, and CPT's known
  - Week 5: Probability and utilities
  - Week 9: Conditional independence and inference (exact and approximate)
  - Week 10: Exact state estimation over time
  - Week 11: Approximate state estimation over time
- This week: What if they're not known?
  - Also Bayesian networks for classification
  - A type of machine learning

- Next week: Machine Learning
  - Just a taste focus on concept learning = classification



- Next week: Machine Learning
  - Just a taste focus on concept learning = classification
- Week 14: Classical planning
  - Reasoning with first order representations



• Next week: Machine Learning

- Just a taste - focus on concept learning = classification

- Week 14: Classical planning
  - Reasoning with first order representations
  - So far we've dealt with propositions



• Next week: Machine Learning

- Just a taste - focus on concept learning = classification

- Week 14: Classical planning
  - Reasoning with first order representations
  - So far we've dealt with propositions
  - Back to known transitions, known state, etc.



• Next week: Machine Learning

- Just a taste - focus on concept learning = classification

- Week 14: Classical planning
  - Reasoning with first order representations
  - So far we've dealt with propositions
  - Back to known transitions, known state, etc.
- Week 15: Philosophical foundations and ethics



• Next week: Machine Learning

- Just a taste - focus on concept learning = classification

- Week 14: Classical planning
  - Reasoning with first order representations
  - So far we've dealt with propositions
  - Back to known transitions, known state, etc.
- Week 15: Philosophical foundations and ethics

It's all about building agents

#### Sense, decide, act



• Next week: Machine Learning

- Just a taste - focus on concept learning = classification

- Week 14: Classical planning
  - Reasoning with first order representations
  - So far we've dealt with propositions
  - Back to known transitions, known state, etc.
- Week 15: Philosophical foundations and ethics

It's all about building agents

Sense, decide, act

Maximize expected utility



# **Topics not covered**

Constraint satisfaction

#### (Chapter 6)

- Knowledge representation and reasoning
  - (Chapters 7-9, 11, 12)

(Sections 17.5, 17.6)

- Game theory and auctions
- Aspects of learning
- Natural language
- Vision

1

Robotics



- (Chapters 22, 23)
  - (Chapter 24)
  - (Chapter 25)

