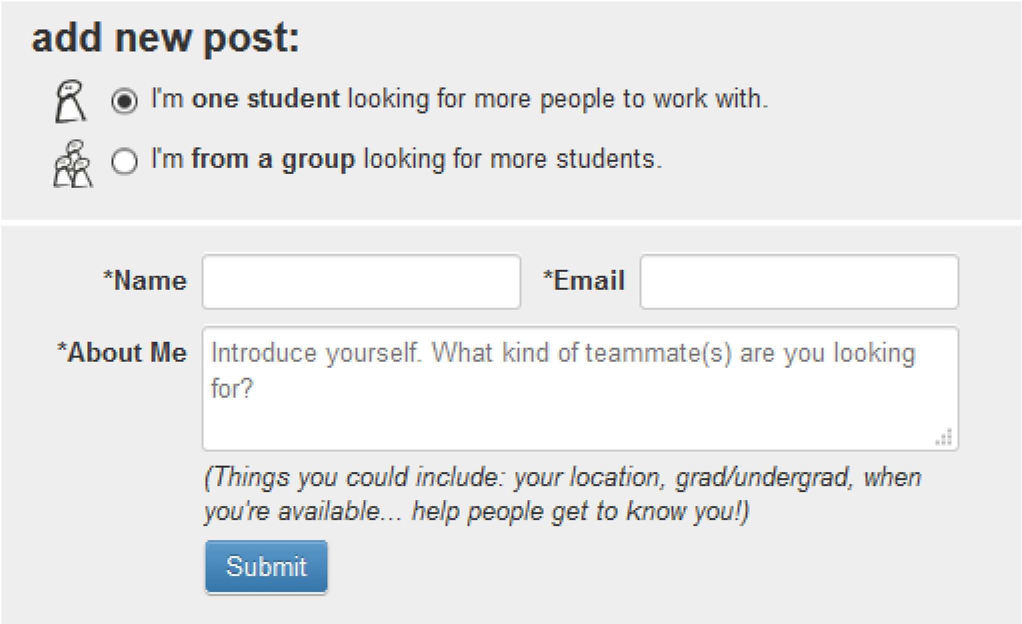
Project

- Topic
  - Use what you have learned in this course to solve a problem of your choice.
  - We will release F22 slides of the remaining topics (see Blackboard → Project)
    - Probabilistic temporal models
    - Markov decision processes
    - Reinforcement learning
    - Machine learning

Project

- Group
  - 1-5 people in each group
    - Good to have more ppl
  - You may use the Piazza “search for teammates” function
- Schedule
  - By late Dec: form groups
  - Early Jan: proposal presentation
  - Jan. 25-26 (Week 18): final presentation, report submission



Project

- You are free to come up with your own topics, but:
  - choose topics/methods covered in this course
  - no need to make it too complicated
- Some possible topics
  - Build an agent to play a game (e.g., 2048, Five in a Row). Implement different methods (minimax? RL?) and compare their performance.
  - Formulate a real world problem (e.g., class arrangement) as CSP and solve it by implementing the methods taught in class.
  - Formulate a real world problem as a Bayesian net or a probabilistic temporal model (e.g., stock price, music). Implement probabilistic inference to solve it.
  - Implement different machine learning algorithms and compare their performance on multiple datasets.

Project

- Grading
  - 15% of the total grade
  - Criteria
    - relevance to this course
    - soundness, substance
    - quality of the report and presentation

Midterm Exam

- Time
  - in class (10:15-11:55am) on Nov. 22 (Wed)
- Location
  - 教学中心 101
  - Seat arrangement TBA
- Format
  - Closed-book. You can bring an A4-size cheat sheet and nothing else.
  - 10 multiple-choices, 4 problems
- Grade
  - 25% of the total grade
- 计算器 ✗ 涂卡笔 ✓

- F2018 midterm exam paper is available at: Blackboard menu → Previous Exams

Midterm Review

Disclaimer

- Topics covered in this review may not appear in the exam.
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Search

- Definitions
  - State space, successor function, start/goal states
  - Completeness, optimality
- Tree search
  - Uninformed Search
    - DFS, BFS, UCS
  - Informed Search
    - Heuristic, admissible heuristic
    - Greedy, A*
- Graph Search
  - A* with consistent heuristic

Constraint Satisfaction Problems

- CSP
  - Find an assignment to a set of variables that satisfies a set of constraints
- Basic solution: backtracking search
- Speed-ups:
  - Filtering
    - Forward Checking, Arc Consistency
  - Ordering
    - Minimum Remaining Values, Least Constraining Value
  - Structure
    - Tree structured, Cutset conditioning
- Iterative min-conflicts (local search) is often effective in practice

Adversarial Search

- Adversarial Search
  - Game tree, Minimax
- Resource Limits
  - Depth-limited search
  - Limiting branching factor
- Game Tree Pruning (alpha-beta pruning)
  - α: MAX's best option on path to root; prune if value of MIN $\leq \alpha$
  - β: MIN's best option on path to root; prune if value of MAX $\geq \beta$
- Uncertain Outcomes
  - Expectimax

Propositional logic

- Representation
  - Syntax
    - Proposition symbols, their compositions using connectives
  - Semantics
    - Each model specifies true/false for each proposition symbol
    - Rules for evaluating truth with connectives
- Inference
  - Resolution (for Conjunctive Normal Form)
- Concepts
  - Validity, satisfiability, entailment, proof, soundness, completeness, etc.

Propositional logic - Horn logic

- Representation
  - $P1 \wedge P2 \wedge P3 \ldots \wedge Pn \rightarrow Q$
- Inference
  - Modus Ponens
  - Forward chaining
  - Backward chaining

First-order logic

- Syntax
  - Constant, predicate, function, variable, connective, quantifier (universal, existential), equality
  - Atomic sentence, term
- Semantics
  - A model contains: objects, relations, interpretation
- Inference
  - Propositionalization (universal/existential instantiation)
  - Unification
  - Forward/backward chaining
  - Resolution

Semantic web

- Not to be covered in the exam ☺

Bayesian networks

- Syntax
  - DAG + CPTs
- Semantics
  - Global semantics
  - Conditional independence semantics, Markov blanket
  - D-separation

- Markov networks
  - Undirected graph + potentials
  - Semantics

Bayesian networks: Inference

- Exact inference
  - Inference by enumeration
  - Variable elimination
    - Interleave join (pointwise product) and elimination (summing out)
  - Efficient inference on polytrees

- Approximation inference
  - Prior Sampling
  - Rejection Sampling
  - Likelihood Weighting
  - Gibbs Sampling

Probabilistic logic

- Not to be covered in the exam ☺

Good Luck!