

## CS 540-2 Midterm Exam Topics

### 1. Introduction

Will *not* cover Chapters 1 and 2 or the Introduction powerpoint slides.

### 2. Uninformed Search

Problem solving as search, problem representation in terms of states, goal test, operators, state-space graph search formulation, closed world assumption, expanding a node, frontier/open list, partial solution path, solution path, search tree, breadth-first search, depth-first search, chronological backtracking, uniform-cost search, iterative-deepening search, bidirectional search, completeness, optimality/admissibility, time and space complexity, detecting repeated states, explored/closed list.

### 3. Informed Search

Heuristic function, evaluation function, best-first search, greedy best-first search, beam search, algorithm A, algorithm A\*, admissible heuristic, consistent heuristic, better informed heuristic, devising heuristics.

### 4. Local Search

Local search problem formulation, operators, neighborhood, move set, hill-climbing algorithm, local optima problem, hill-climbing with random restarts, WalkSAT, stochastic hill-climbing (simulated annealing) algorithm, escaping local optima, Boltzman's equation, cooling schedule, genetic algorithms, crossover, mutation, fitness function, proportional fitness selection, population, crowding.

### 5. Game Playing

Zero-sum games, perfect information games, deterministic vs. stochastic games, game playing as search, search tree, branching factor, ply, minimax principle, minimax algorithm, static evaluation function, alpha-beta pruning, cutoff, alpha-beta pruning algorithm, best case and worst case of alpha-beta vs. minimax, iterative-deepening with alpha-beta, horizon effect, quiescence search, representing non-deterministic games, chance nodes, expectimax value.

### 6. Unsupervised Learning

Inductive learning problem, unsupervised learning problem, feature space, feature, attribute, examples, labels, classes, training set, testing set, classification problems, inductive bias, preference bias, hierarchical agglomerative clustering algorithm, single linkage, complete linkage, dendrogram,  $k$ -means clustering algorithm, cluster center.

### 7. Supervised Learning: K-Nearest-Neighbors and Decision Trees

$K$ -nearest neighbor algorithm, Decision Trees, Ockham's razor, decision tree algorithm, information gain, max-gain, entropy, conditional entropy, remainder, overfitting problem, pruning, training set, tuning set, testing set, setting parameters,  $k$ -fold cross validation, leave-one-out cross validation, random forests, bagging ensemble learning.

### 8. Constraint Satisfaction

Problem formulation in terms of variables, domains and constraints, constraint graph, depth-first search, backtracking with consistency checking, most constrained variable heuristic, most constraining variable heuristic, least constraining value heuristic, min-conflicts heuristic, min-conflicts algorithm, forward checking algorithm, arc consistency algorithm (AC-3).