CS 344 - Guide 3

- Constraint satisfaction problem:
  - What are the three components of a CSP formulation?
    - Set of variables
    - Set of domains
    - Constraints on variables
  - How would you formulate a CSP for the map coloring problem for the seven Australian states?
    - Variables: the 7 Australian states
    - Domains: the set of colors used
    - Constraints: adjacent states can't be of the same color
    - Solution: requires a minimum of 3 colors
  - Compare and contrast:
    - Arc consistency vs. path consistency
      - Arc consistency: a variable whose admissible values are consistent with some admissible value of a second variable.
        - For all A, element of X, there exists a B, element of Y, such that (A,B) is an element of C.
        - For all B, element of Y, there exists an A, element of X, such that (A,B) is an element of C.
      - Path consistency: a pair of variables is path-consistent with a third variable if each consistent evaluation of the pair can be extended to the other variable in such a way that all binary constraints are satisfied.
        - For each subset {x,y,z} of its variables, C of x,z is a subset of C of x,y * C of y,z
        - For each subsequence x,y,z of its variables:
          - C of x,y is a subset of C of x,z * C^T of y,z
          - C of x,z is a subset of C of x,y * C of y,z
          - C of y,z is a subset of C^T of x,y * C of x,z
    - Backtracking search vs. local search (e.g., using Min-Conflicts) for CSP's
      - Backtracking search:
        - A general algorithm for finding all or some solutions to computation problems that incrementally builds candidates to the solutions, and abandons a candidate (backtracks) as soon as it determines that the candidate cannot possibly be completed to a valid solution.
        - Meta-heuristic rather than a specific algorithm – guaranteed to find all solutions to a finite problem in a bounded amount of time.
        - Depends on user-given black box procedures that:
          - Define the problem to be solved
          - The nature of the partial candidates
          - How partial candidates are extended into complete candidates
      - Local search:
        - A heuristic method for solving computationally hard optimization problems.
        - Can be used on problems that can be formulated as finding a solution maximizing a criterion among a number of candidate solutions.

- Move from solution to solution in the space of candidate solutions (the search space) by applying local changes, until a solution deemed optimal is found or a time bound elapses.