Review: Constraint Satisfaction

- **Given:**
  - A set of variables: \(x_1 \ldots x_n\)
  - A finite domain of values for each variable: \(D_1 \ldots D_n\)
  - A set of constraints: \(C_1 \ldots C_m\)

- **Find:** An assignment of values to variables that satisfies the constraints.
Review

• Examples of Constraint Satisfaction Problems
  – N-Queens.
  – House Floorplanning.
  – Job scheduling.
  – Crypt-Arithmetic.
  – Scene Labeling.
  – VLSI Layout and routing.
  – Graph Coloring.
  – Bin Packing.

• Arity

Review

Constraint propagation

• Remove values from domain that are ruled out by constraints
  – Constraint: A > B
  – Domains: A: {3, 5, 7}, B: {4, 6, 8}
  – Arc consistency: A: {5, 7}, B: {4, 6}

• Full propagation can be multi-step
  – Constraints: A > B, B > C
  – Domains: A: {3, 5, 7}, B: {4, 6, 8}, C:{5, 7}
  – Full propagation: A: {7}, B: {6}, C: {5}
Review

CSP Algorithms

• Simple backtrack:
  – Test only at leaves

• Backtrack with early pruning:
  – Test each constraint as soon as its vars are set

• Forward checking
  – When assign variable, establish arc consistency of new value with all unassigned variables

• Full lookahead
  – When assign variable, do full constraint propagation

Another Alpha Prune