Forward Checking

- Idea: Reduce domain of unassigned variables based on assigned variables.
- Each time variable is instantiated, delete from domains of the uninstantiated variables all of those values that conflict with current variable assignment.
- Identify dead ends without having to try them via backtracking.

Comparison of CSP Algorithms

Problem	BT	BT+MRV	BT+FC	BT+FC+MRV
USA	(>1,000K)	(>1,000K)	2K	60
n-queens	(>40,000K)	13,500K	(>40,000K)	817K

Constraint Propagation (Arc Consistency)

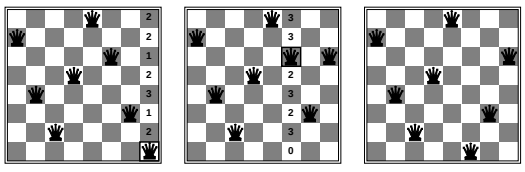
Arc Consistency — state is arc-consistent, if every variable has some value that is consistent with each of its constraints (consider pairs of variables)

- Init: Q is queue with all (directed) arcs (X_i, X_j) in CSP
- WHILE Q is not empty
  - (X_i, X_j) = remove_first(Q)
  - FOREACH $x \in dom(X_i)$
    - IF no $y \in dom(X_j)$ satisfies constraint (X_i, X_j)
      - THEN remove x from $dom(X_i)$
  - IF $dom(X_i)$ changed
    - THEN add all arcs $(X_k, X_i) \notin Q$ to Q

Constraint Propagation (K-Consistency)

- **K-Consistency** generalizes arc-consistency (2-consistency).
- Consistency of groups of K variables.

Local Search for CSPs



Remarks

- Infinite discrete domains and continous domains
- Exploiting special problem structure
- Dramatic recent progress in Constraint Satisfaction. Methods can now handle problems with **10,000** to **100,000** variables, and up to **1,000,000** constraints.