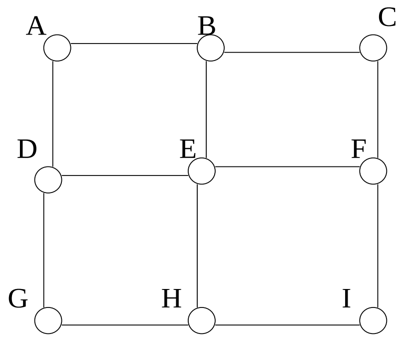


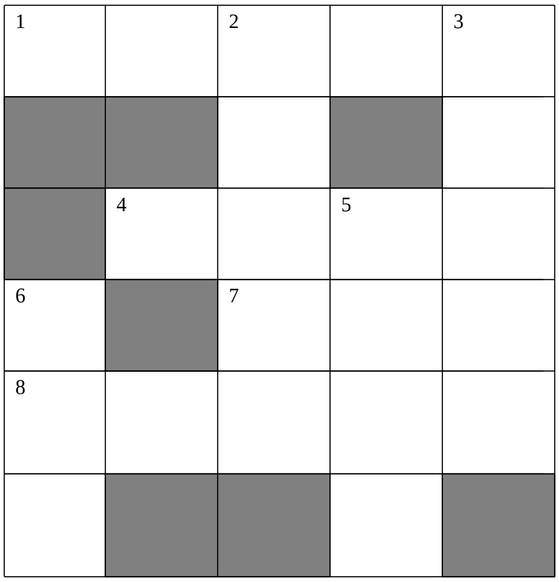
Figure 1: Grid with nine nodes

Rina Dechter, Fall-99

ICS 275a, Assignment 6

1. Read chapter 5 and provide 1-2 paragraphs with comments.
2. Consider Stochastic local search (SLS) algorithms such as GSAT and Walksat.
   (a) Apply algorithm GSAT to the 5-queen problem when your initial assignment is all the queens are on the diagonal. Give at most one page description of tracing the algorithm. Discuss
   (b) Discuss the properties of SLS algorithm.
3. Consider the graph in Figure 1.
   (a) What is the induced-width of the graph? Provide an ordering having minimum induced-width.
   (b) Assume that the graph expresses a binary constraint network with some constraints (e.g., inequalities). Provide a complexity bound using the induced-width for applying algorithm DPC along the optimal induced-width ordering of this problem.
   (c) Can algorithm DPC always decide consistency of every constraint problem having the grid constraint graph?

4. Consider the crossword puzzle:



Word List

aft	laser
ale	lee
eel	line
heel	sails
hike	sheet
hoses	steer
keel	tie
knot	

(a) Model the problem as a binary csp, that is, where the words are the variables (the problem has 8 variables). Draw its constraint graph.

(b) Generate a min-induced-width and max-cardinality ordering of the constraint graph. Generate the induced graph along these orderings. What is the w* of this problem?

(c) What level of directional-i-consistency is guaranteed to generate a backtrack-free representation for the ordered graphs that you picked, no matter what are the exact constraints?

(d) Using the min-induced-width ordering, show the constraints which will be recorded for this specific problem by 1) directional arc-consistency, 2) directional path-consistency 3) adaptive-consistency (Show the constraint subsets generated for all buckets and the actual constraints generated when processing the first 3 buckets).

5. Consider the directional relational path-consistency (DRC_2) algorithm described in Figure 3. Choose a good ordering and apply DRC_2 along that ordering to the graph coloring problem in Figure 2. Show a trace of performance using the bucket scheme.

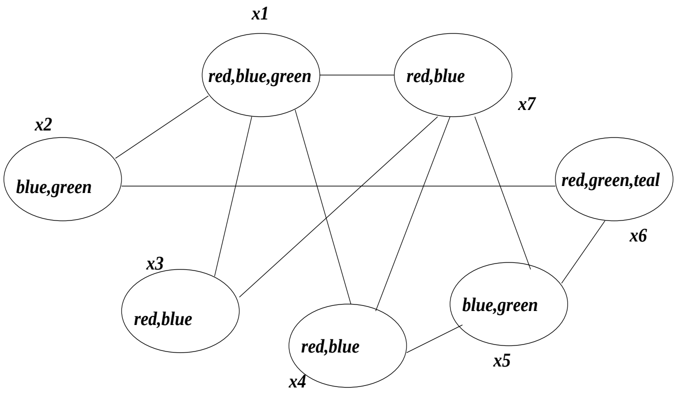


Figure 2: A graph coloring problem.

DIRECTIONAL-RELATIONAL (DRC_2) $(\mathcal{R}, d = x_1, ..., x_n, n)$

1. Partition relations into $bucket_1, ...bucket_n$:

    for $i \leftarrow n$ **downto** 1, put in $bucket_i$ all unplaced relations mentioning x_i.

2. **for** $i \leftarrow n$ **downto** 1 **process** $bucket_i$:

3. **for** every pair of relations R_S and R_T in $bucket_i$ do

4. $A \leftarrow (S \cup T) - \{x_i\}$

5. $R_A \leftarrow \Pi_A(R_S \bowtie R_T)$

6. **if** R_A is the empty relation

7. **then** exit, return "problem inconsistent"

8. else, place R_A below, in the highest bucket mentioning its variables.

8. return the union of all buckets.

Figure 3: Algorithm Directional relational PC