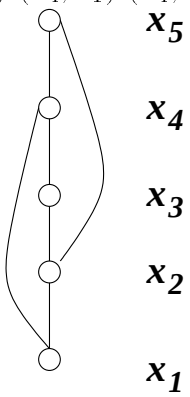
**Rina Dechter, fall-99**

# ICS 270a, Assignment 4

(a) Let $G$ be a constraint graph of a problem having 5 variables $x_1, x_2, x_3, x_4, x_5$ with arcs $(x_1, x_2)$, $(x_2, x_3)$ $(x_3, x_4)$ $(x_4, x_1)$ $(x_4, x_5)$ $(x_5, x_2)$.




For a problem having the constraint graph $G$ and using ordering $d_1 = x_1, x_2, x_3, x_4, x_5$, confirm, reject or answer, and justify your answer:

i. Graph-based backjumping will behave exactly as backtracking.

ii. Gaschnig's backjumping will behave like backtracking.

iii. Conflict-directed backjumping and Gaschnig's backjumping are identical on $G$.

iv. Graph-based learning over $G$ and ordering $d_1$ will never record constraints of size greater than two.

v. If a leaf dead-end occurs at $x_5$, what is the induced-ancestor set $I_5(\{x_5\})$?

vi. If a leaf dead-end occurs at $x_5$ and another internal dead-end at $x_4$, what is the conflict-set recorded by graph-based learning?

(b) How would your answer to question 2 will differ if the arc $(x_2, x_3)$ is ommited.

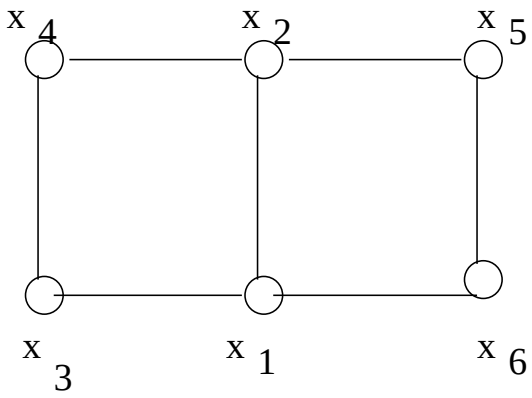
(c) Prove the claim that: "For leaf dead-ends, jumping back to the parent (rather than to the closest node in the induced ancestors) will not cause any solution to be missed".

(d) Consider the crossword puzzle in Figure 1.2 formulated using the dual-graph representation (see graph below). Using the ordering $x_1, x_2, x_5, x_6, x_4, x_3$ show a trace, whose length is limited by a 1 page description, for each of the algorithms:

i. graph-based backjumping.

ii. graph-based backjumping-learning.

iii. backjump-learning.

iv. Bound the complexity of graph-based backjumping on the crossword puzzle along the ordering above.

v. Bound the complexity of graph-based backjumping-learning using that ordering.