CS 4613 **Fall 2023**
HW 3 Solutions **E. K. Wong**

Total # questions = 4. Total # points = 60..

1. [10 points] In the time and space complexities below, *n* equals the number of variables and *d* equals the size of the domains.

(a) Regular Depth-First Search:

Time complexity = $O(n!\,d^n)$. We derived this in class.

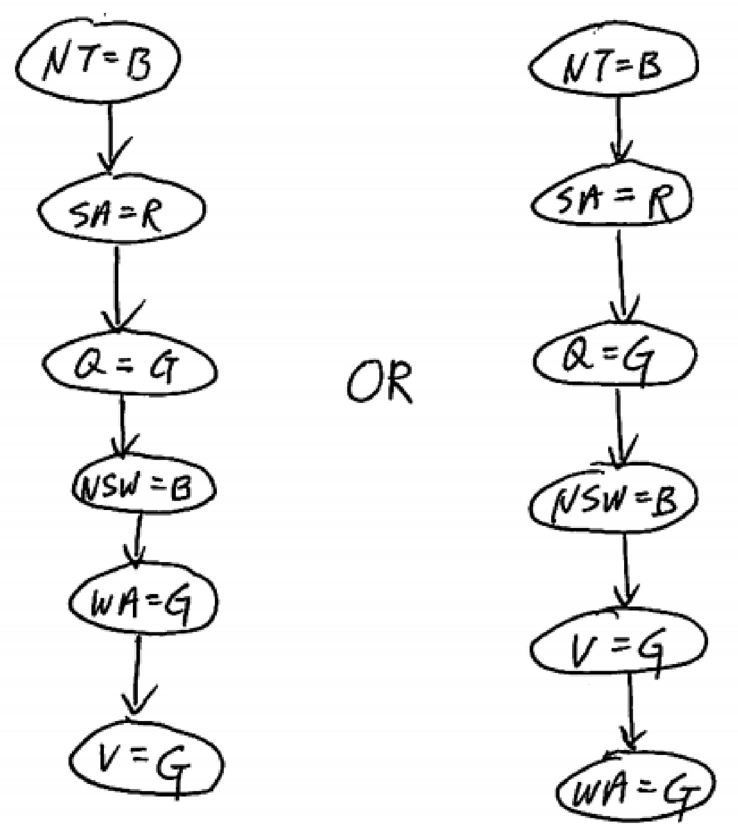
Space complexity = $O(n^2d)$. Space complexity of regular depth-first search = $O(bm)$. For CSP problems, $b = nd$ and $m = n$ since level *n* is the deepest you can go. $O(bm)$ therefore equals $O(n^2d)$.

(b) Backtracking algorithm for CSP:

Time complexity = $O(d^n)$. We derived this in class.

Space complexity = $O(n)$. For backtracking, only one action is executed at a time, and therefore, only one child node is generated at a time.

2. [15 points] There are two possible answers for this problem (as shown below.) You can give either one. The backtracking algorithm generates only one child node at a time.



3. [15 points] To solve this problem, you can apply the MRV and Degree heuristics to select a variable at each level of the tree. The MRV heuristic selects the variable with the fewest *legal* values and the Degree heuristic selects the variable with the greatest number of *unassigned* neighbors. After a variable has been selected at each level, you can assign a legal value (any legal value) from its domain and then move on to select the next variable. Depending on the value you assign to the selected variable at each level, there are many possible answers to this problem. Below is one of them:

$$O - X_1 - E - X_2 - T - W - N$$

4. [20 points]

(a) After applying forward checking, the domain values for B, C and D are as shown in the table below.
(b) Arcs in the queue initially: B → C, C → B, B → D, D → B, C → D and D → C.
After applying AC-3, the domain values for B, C and D are as shown in the table below.

	B	**C**	**D**
Initial domain values	RG	R	RGB
After Forward Checking	G	R	GB
After AC-3	G	R	B