

1)

a. **DFS (draw tree)-fringe**

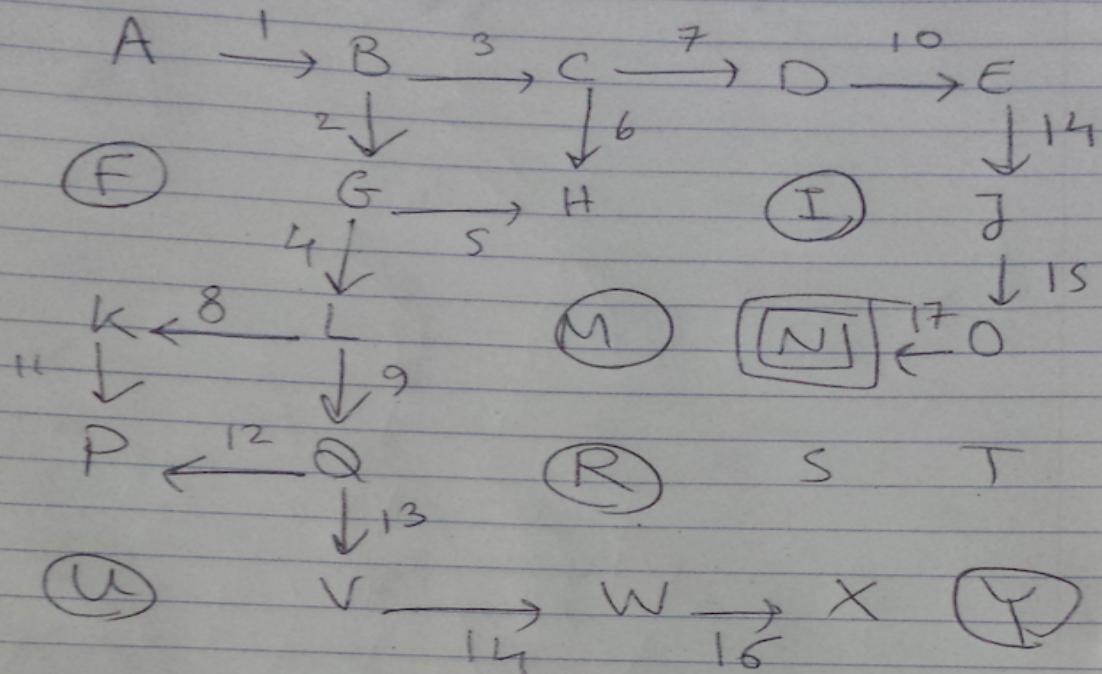
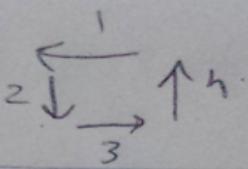
1. A
2. AB
3. ABG
4. ABGL
5. ABGLK
6. ABGLKP
7. ABGLKPQ
8. ABGLKPQV
9. ABGLKPQVW
10. ABGLKPQVWX
11. ABGLKPQVWXS
12. ABGLKPQVWXST
13. ABGLKPQVWXSTO
14. ABGLKPQVWXSTON (expanded path)

ABGLKPQVWXSTON (expanded path) ==solution path

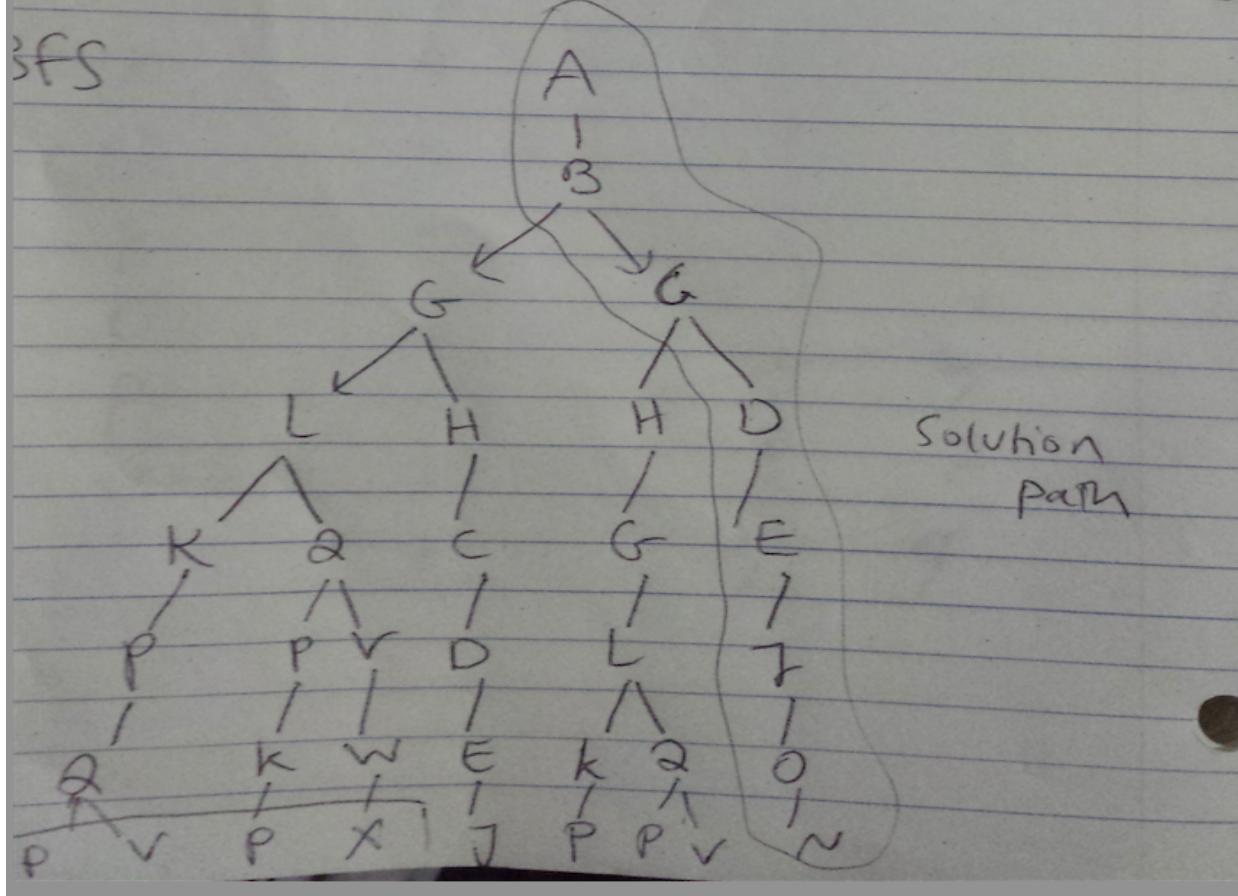
b. **BFS (draw tree)**

ABCDEJON is the solution path

BFS



SFS

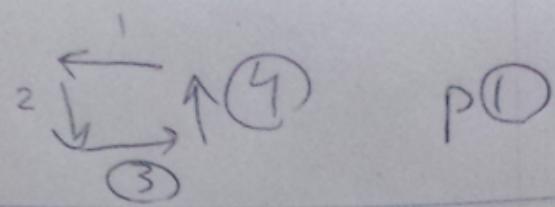


Expanded Path: ABGCLHHDKQC~~G~~EPPVDLJQKWEKQOPVPXJPPVN

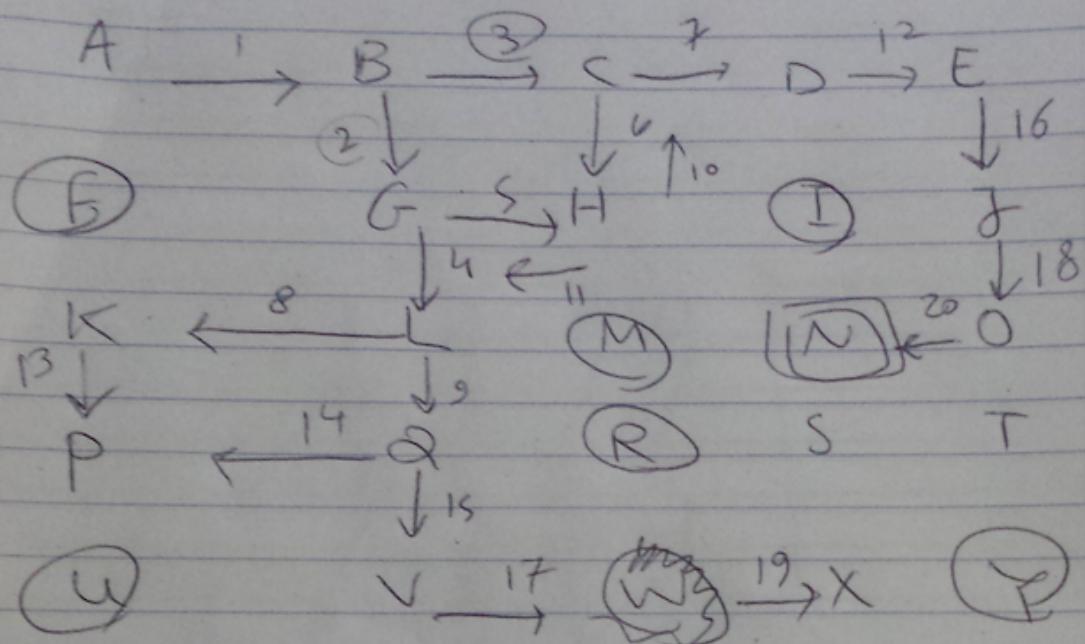
c. **IDS**

IDS:

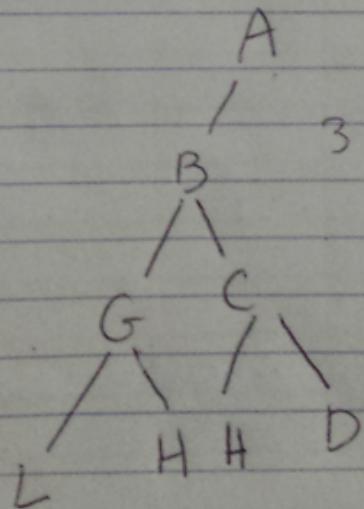
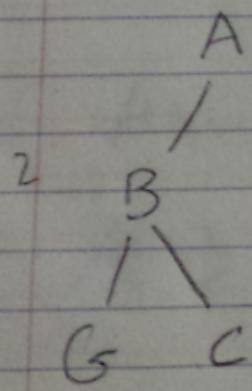
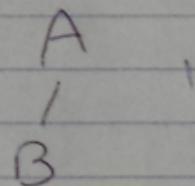
ID's

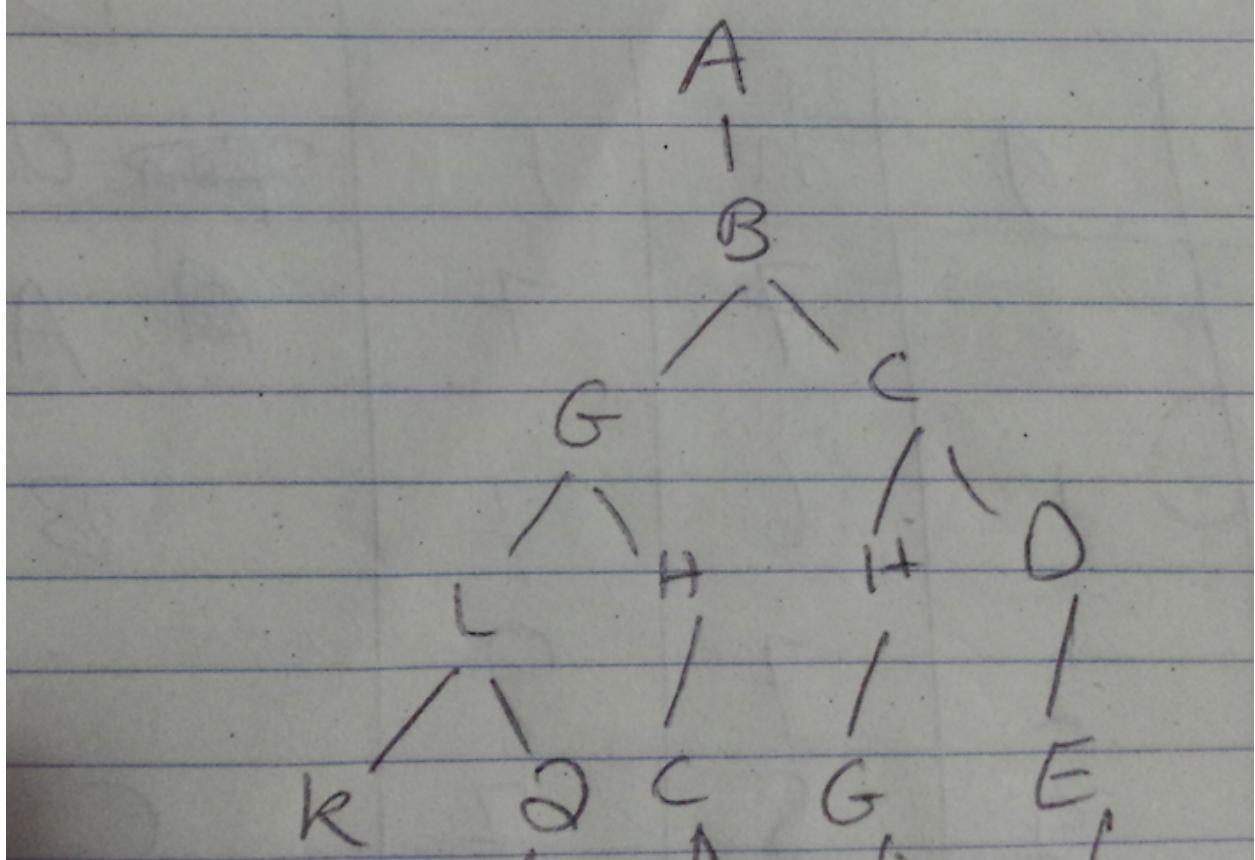
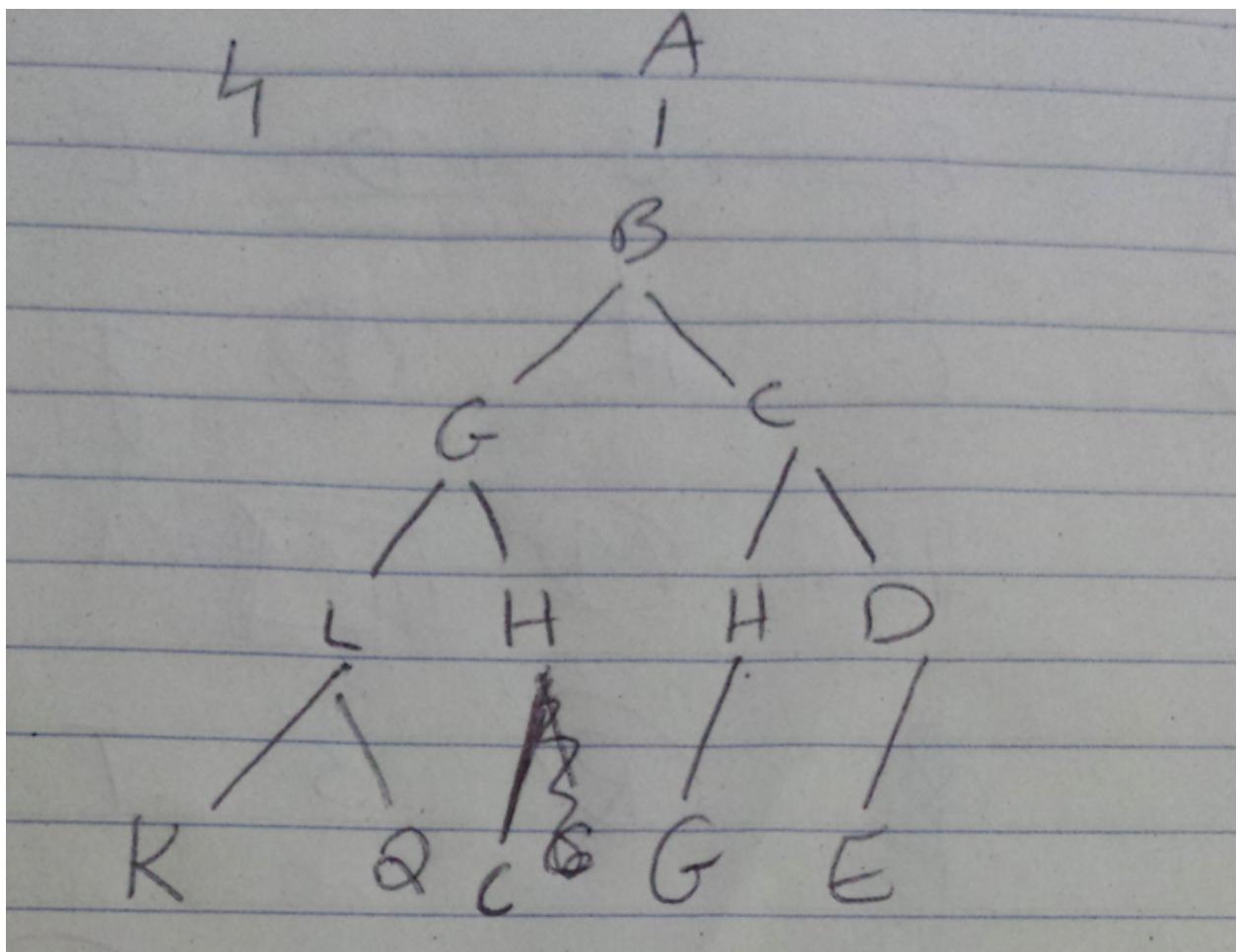


p①



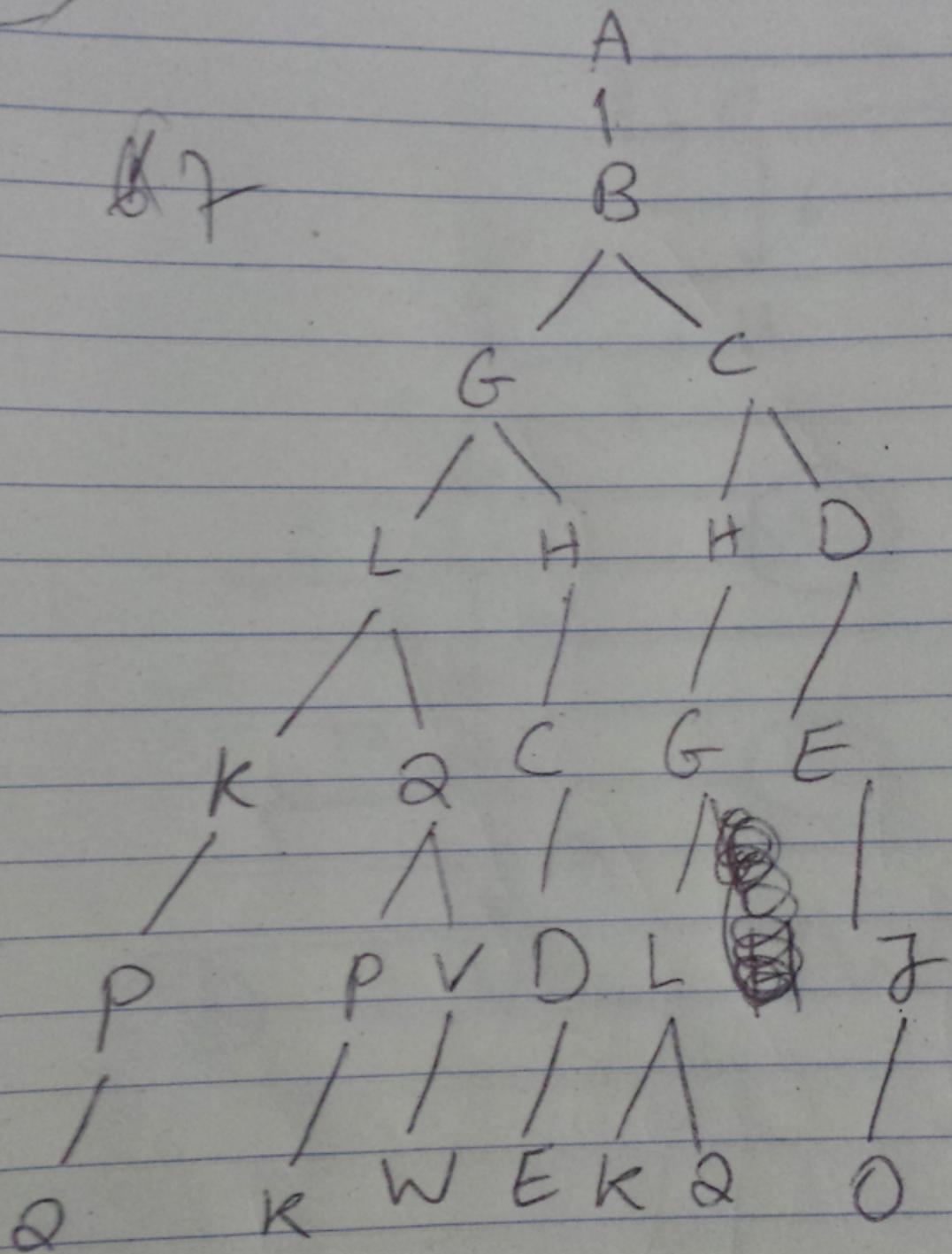
◦ A





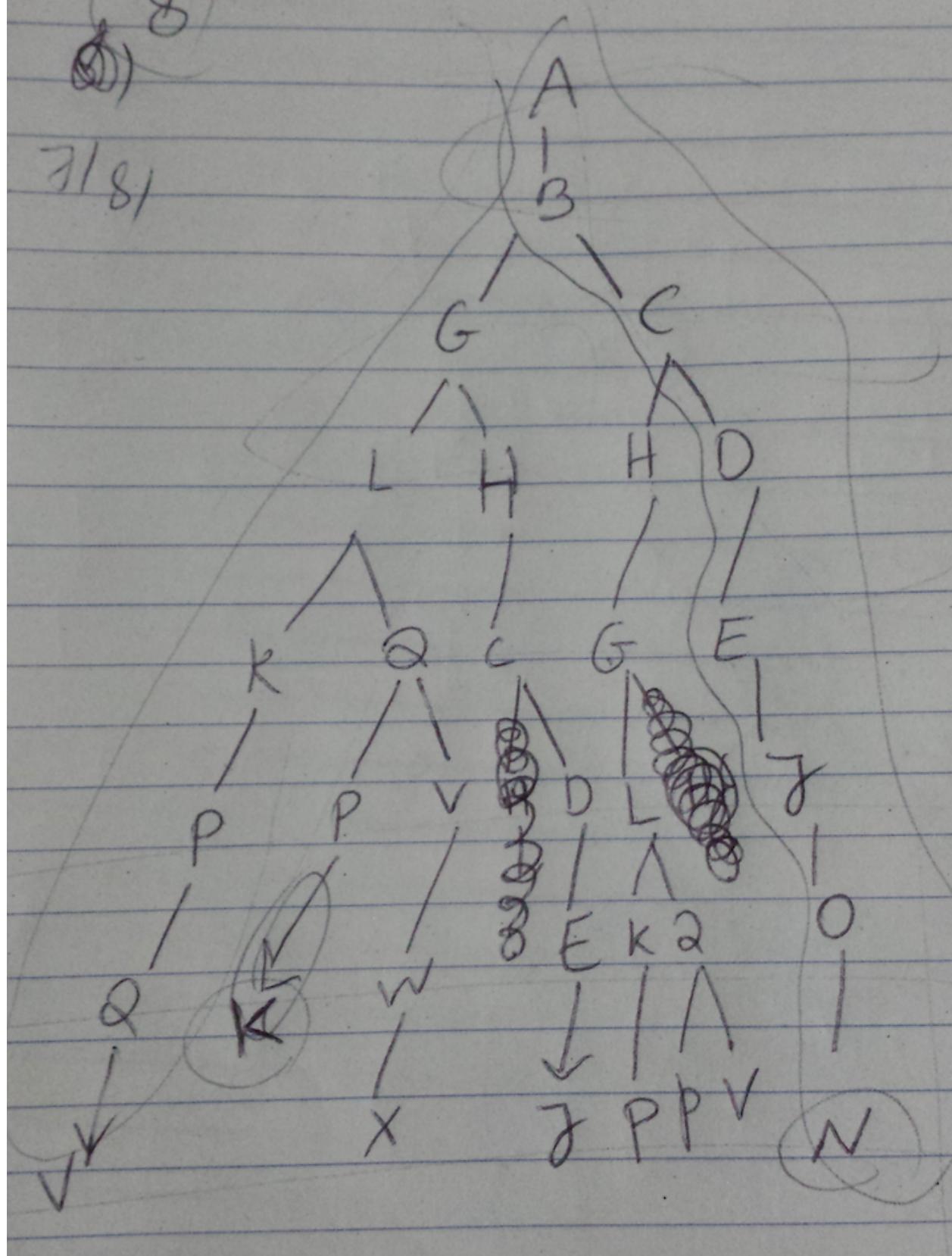
(P4)

(B7)



8

3181



Solution Path: ABCDEJON

d. Manhattan distance is an **admissible heuristic here** as it doesn't over-estimate
 Manhattan heuristic $h(n)$ is admissible because for every node n , $h(n) \leq h^*(n)$, where $h^*(n)$ is the true cost to reach the goal state from n . When we check this for the states, it holds!
 e.A*

OPEN	g	h	f=g+h
A	0	5	5
B	1	4	5
G	2	3	5
C	2	3	5
H	3	2	5
D	3	2	5
E	4	3	7
L	3	2	5
K	4	3	7
Q	4	3	7
J	5	2	7
O	6	1	7
P	5	4	9
N	7	0	7
T	7	2	9

closed order in A* is as follows: ABCDGHLEJKON

2) Program part written part regarding heuristic:

So for example one of the results (random value effect) is 22097 for output23, which is lower than output22 (the current highest bound). The fact is our answer (even though not deterministic and random) has a upper bound and always had answers better or equal to h2. We are just using the idea of multiplying it by a random number between 0 and 1 which yet saves the lower bound which was greater than zero. Correctness is also observed in the algorithm runs.