CS 4613 **Fall 2023**
HW 1 Solution **E. K. Wong**

Total # of questions = 5. Total # Points = 85.

1. [10 points]2.5 points each **(a)** F **(b)** T **(c)** T **(d)** F

2. [30 points]

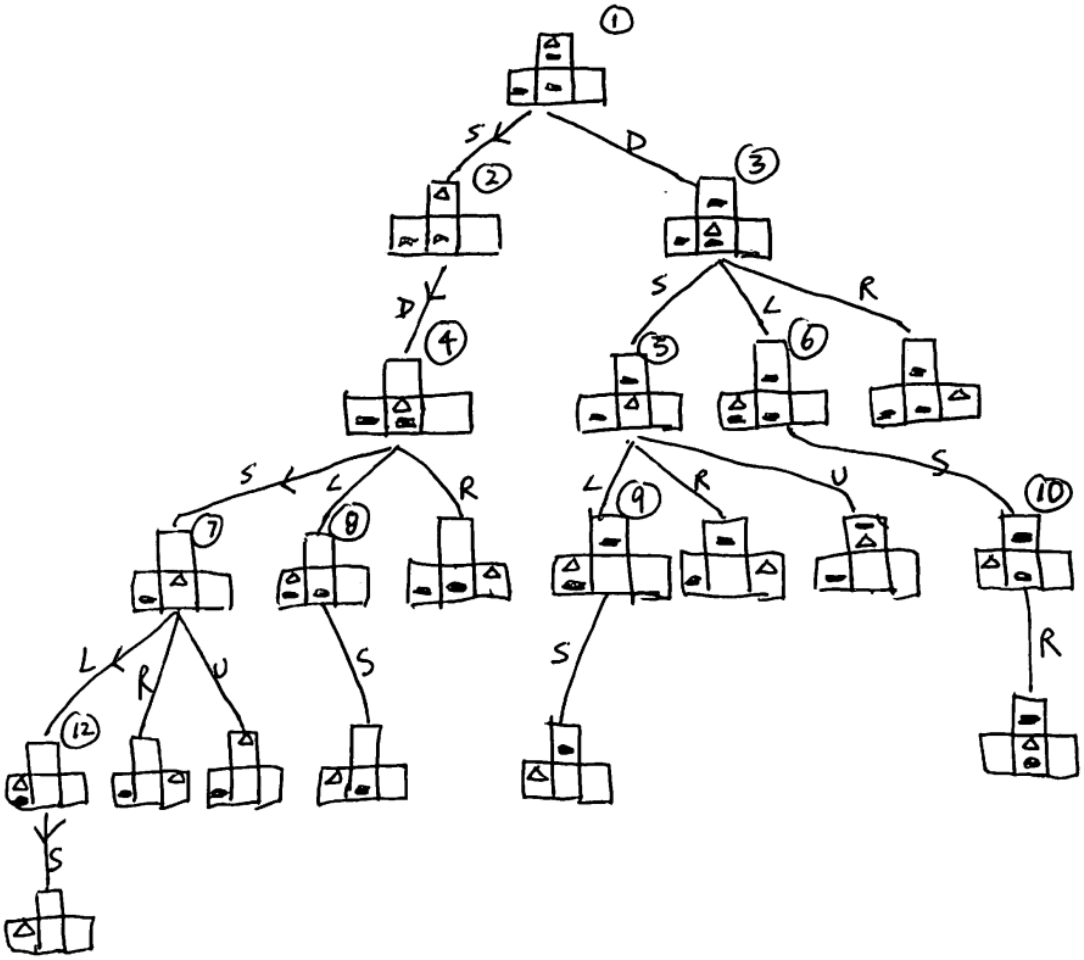
(a) **5 points.** Let the vacuum cleaner be L and the four rooms be A, B, C and D. The size of the state space is the total number of combinations for the values of the five variables:

$$L \times A \times B \times C \times D = 4 \times 2 \times 2 \times 2 \times 2 = 64.$$

(b) **5 points.** Let the vacuum cleaner be L, the three rooms with dirt be A, B and C, and the room without dirt be D. The total number of reachable states is the total number of combinations for the possible values of the five variables:

$$L \times A \times B \times C \times D = 4 \times 2 \times 2 \times 2 \times 1 = 32.$$

(c) 15 points.



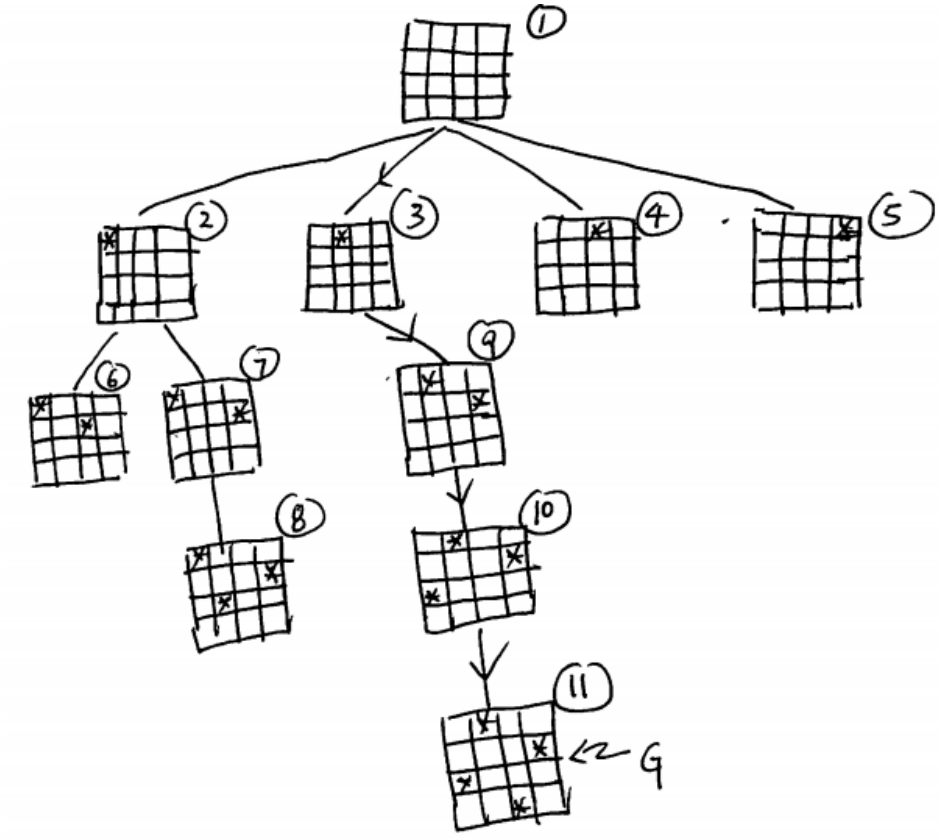
(d) 5 points. Yes. Depth-first search with tree search may end up with infinite loops but depth-first search with graph search will be able to find a solution since the problem of infinite loops is eliminated and the number of tree nodes is bounded by the size of the state space.

3 [10 points]

(a) 5 points. L1, R1, U1, D1, L2, R2, U2 and D2 where numbers 1 and 2 are labels for the two blank positions.

(b) 5 points. 16! / 2! = 2.09227899 E+13 / 2 = 1.04613949E+13

4 [15 points] The solution below is not unique. Depending on which node you choose to expand at each level, you may end up with a different tree which is also correct.



5. [20 points] Graph search (does not allow repeated states): Labelling of the optimal goal node is optional.