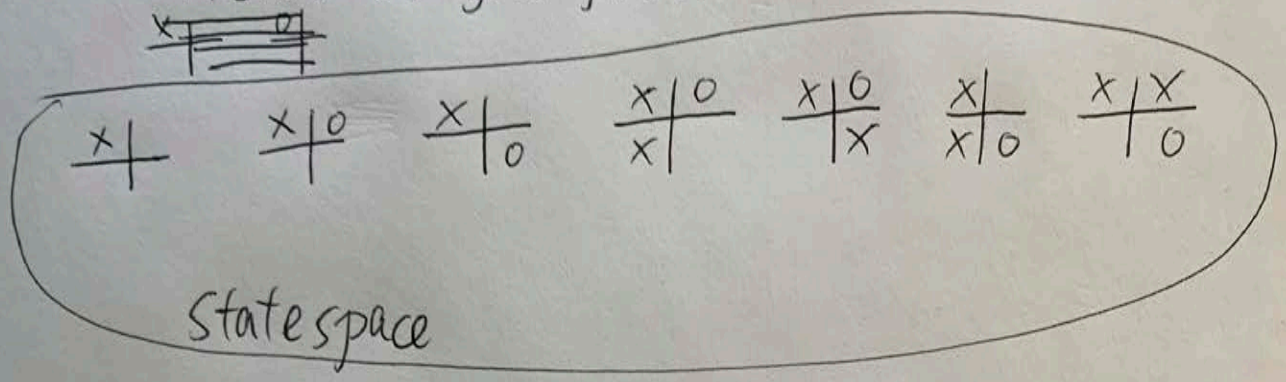
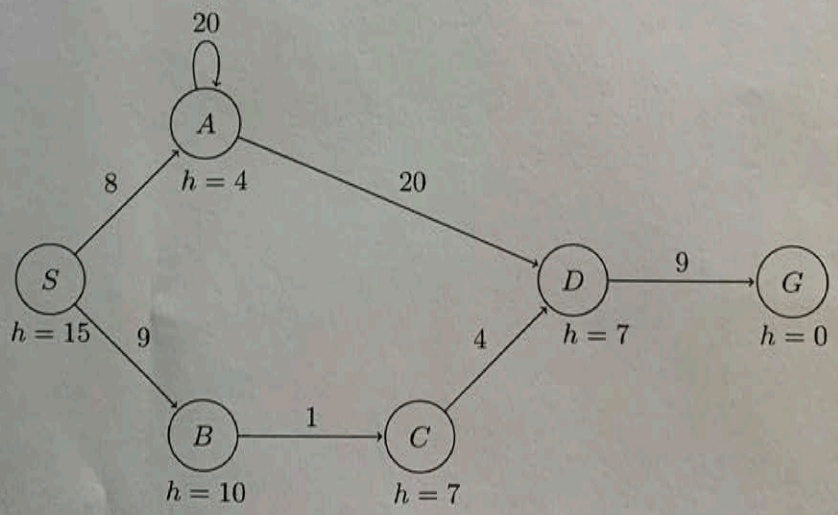
B351/Q351 WORKSHEET 5: SEARCH

Question 1. Draw the state space of tic-tac-toe played in a 2×2 board. To simplify your work, you may ignore states that can be obtained from another by rotation or mirror symmetry. Assume X goes first.



Question 2. Consider the graph below with six states. The successors of each node are indicated by the arrows out of that node. Step costs are given next to each edge. Heuristic values are given next to each node (as $h = x$). For each search strategy below, show the order in which nodes are expanded, with S as the start state and G as the goal state. Please end your paths with the goal node that is found, if any, even if it's not expanded. Also show the path from start to goal and its cost, or write "None" if no path is found. Assume the successor function returns states in alphabetic order, e.g. the children of S are (A, B) and the children of A are (A, D), in that order.



(a) **Depth First Search**

Order of expansion of the nodes: S B C D

Path found: S→B→C→D→G Cost of path found: 23

(b) **Breadth First Search**

Order of expansion of the nodes: SAB AD

Path found: S→A→D→G Cost of path found: 37

(c) **Iterated Deepening Search** depth limit = 2

Order of expansion of the nodes: SBCA DA SBCD

Path found: ~~None~~ S→B→C→D→G Cost of path found: 23

(d) **(Greedy) Best-First Search with** $f(N) = h(N)$

Order of expansion of the nodes:

Path found: None Cost of path found:

(e) **Uniform Cost Search**

Order of expansion of the nodes: SABCDG

Path found: S→B→C→D→G Cost of path found: 23

(f) **A* Search**

Order of expansion of the nodes: SABCDG

Path found: S→B→C→D→G Cost of path found: 23

(g) Is the heuristic admissible at nodes B and C? Yes/No and why?

$\because \frac{h(B)}{10} \leq \frac{h^*(B)}{15}$ $\therefore$ h is admissible at B.

$\because \frac{h(C)}{7} \leq \frac{h^*(C)}{13}$ $\therefore$ h is admissible at C.