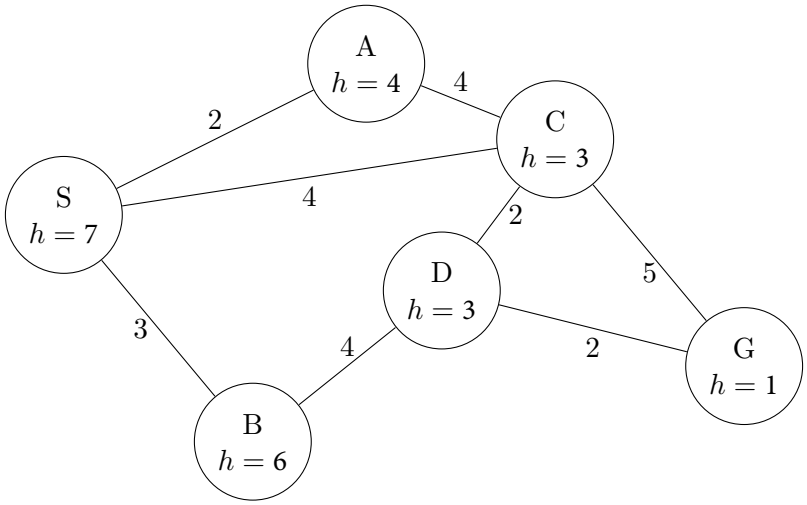
2. (20 points) Search Algorithms

Consider the following search problem with initial state — S, goal state — G, path costs indicated along edges, and a heuristic given.



For each of the following **graph search** strategies, report (i) the order in which states are expanded and (ii) the path returned by the *graph search*. Assume all ties (node orderings) use alphabetical ordering to select what is expanded first, e.g., S-A-D will be expanded before S-B-C. *Note, this requests using the graph search method (a state should only be expanded once).*

Search Method	States Expanded	Path Returned
Example	S, A, B, C, D, G	S-B-D-G
(a) Depth-first search		
(b) Breadth-first search		
(c) Uniform cost search		
(d) Greedy search using h		
(e) A*using h		

3. (5 points) Word Search

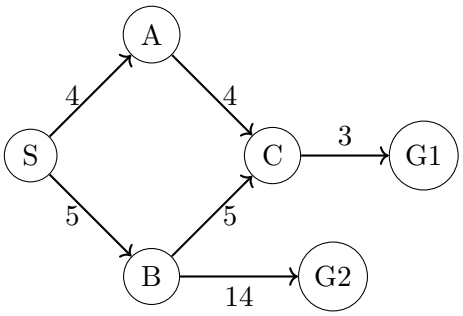
Consider a word search puzzle. Given a starting word, and ending word, generate a sequence of steps between the two by changing a single letter each time. All intermediate words must be real (in the dictionary). For example, with the start and end word pair of (`boat`, `gold`), a possible sequence is:

$$\texttt{boat} \rightarrow \texttt{coat} \rightarrow \texttt{colt} \rightarrow \texttt{cold} \rightarrow \texttt{gold}.$$

Which search strategy would be better for this problem: depth-first search or breadth-first search? Why? Explain your answer in terms of branching factor and the size of the total state space. *Hint: It may help to draw part of the search space.*

4. (13 points) A*and Heuristics

Consider the search state graph shown below, where S is a start state and $G1$ and $G2$ are goal states.



	S	A	B	C	G1	G2
h_1	8	5	3	2	1	0
h_2	0	0	0	0	0	0
h_3	7	4	4	1	0	0

(a) (3 pts) Which heuristics are admissible (or write *none*)?

(b) (3 pts) Which heuristics are consistent (or write *none*)?

(c) (3 pts) For heuristic h_1, what order will nodes (paths) be added to the fringe in A*graph search? Present info as ((S), $g + h = f$), ((S-A-C), 12+1=13), etc.

(d) (2 pts) For heuristic h_1, what order will states be added to the closed/explored set in A*graph?

(e) (2 pts) For heuristic h_1, what path with A*graph search return?