Problem #3: (40pts)

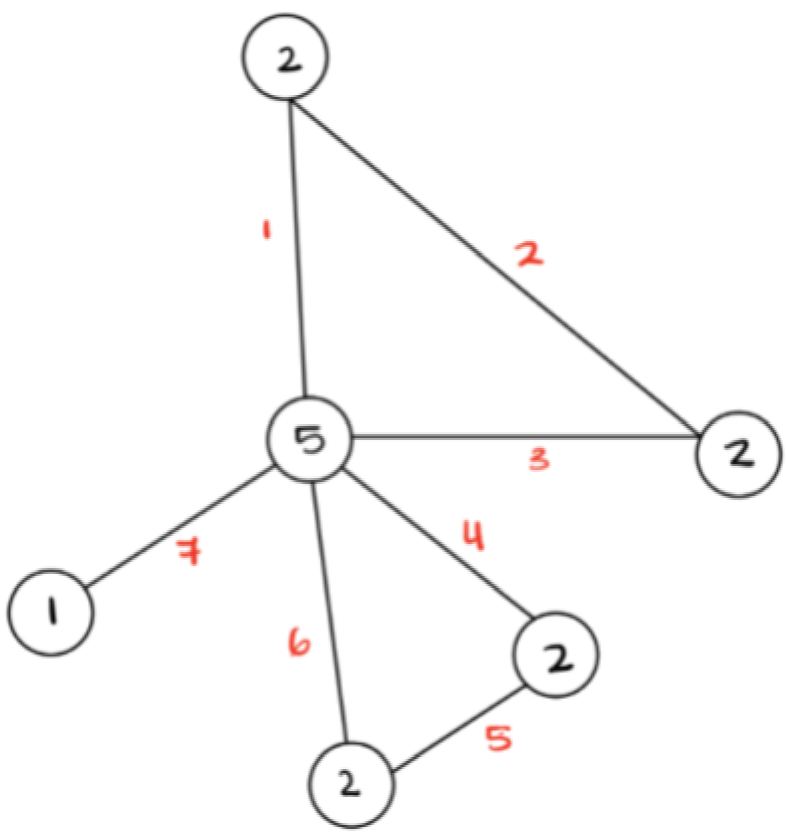
(a) Either draw a graph with the following specified properties, or explain why no such graph exists:

A simple graph with five vertices with degrees 2, 3, 3, 3, and 5.

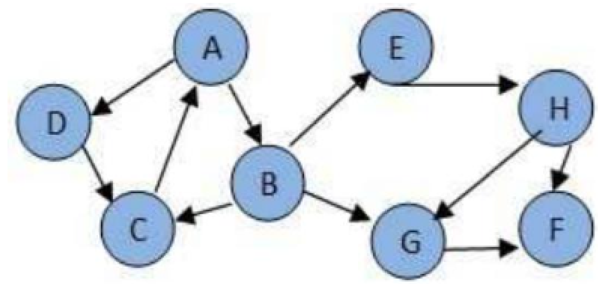
- A simple graph cannot contain multiple edges or self loops. It also needs 5 vertices to connect to 5 but only has 4 vertices that are able to connect to it.

(b)How many edges does a graph have if its degree sequence is 5, 2, 2, 2, 2, 1? Draw such a graph.

- It has 7 edges.

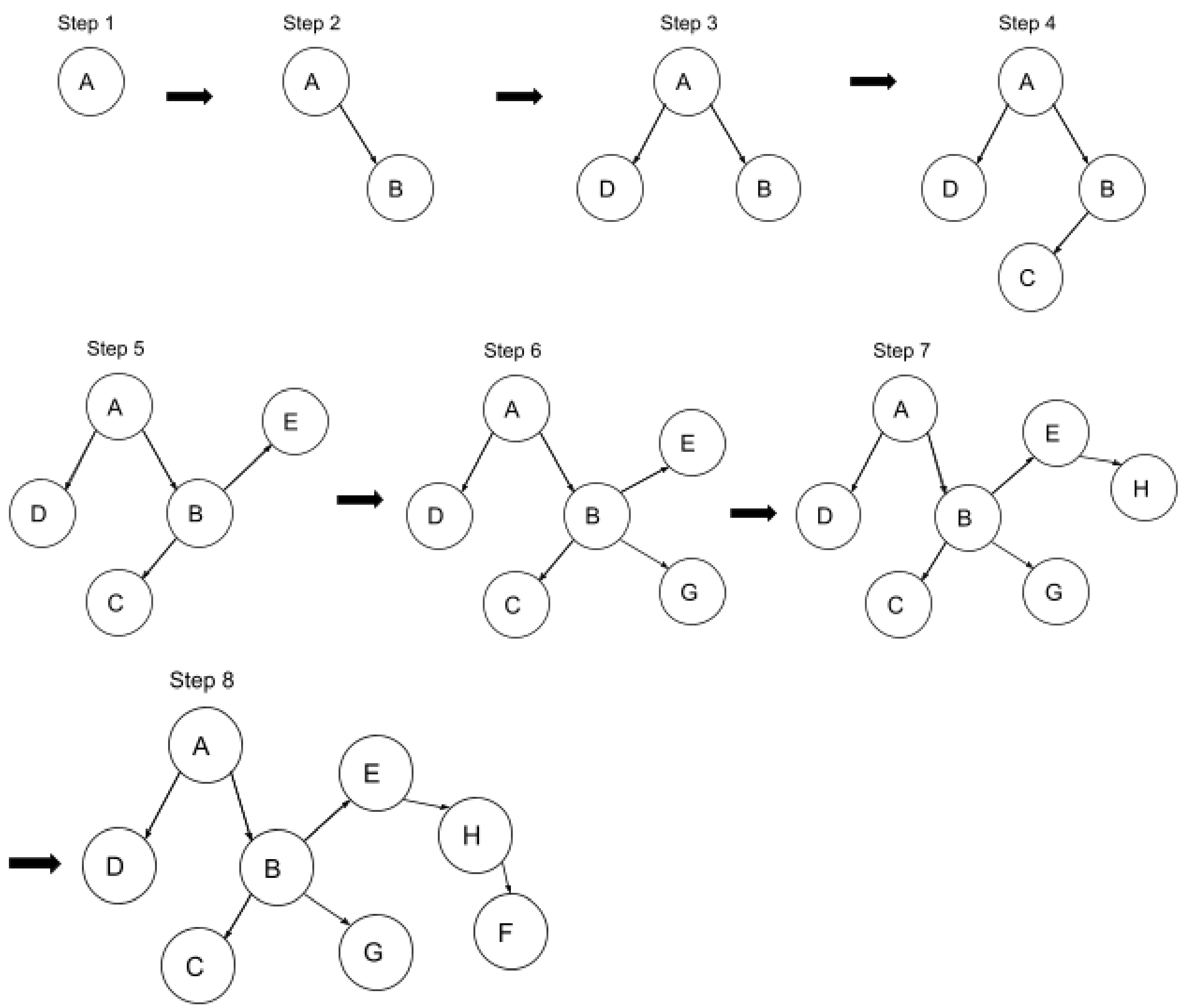


(c) Consider the following graph. If there is ever a decision between multiple neighbor nodes in the BFS or DFS algorithms, assume we always choose the letter closest to the beginning of the alphabet first.



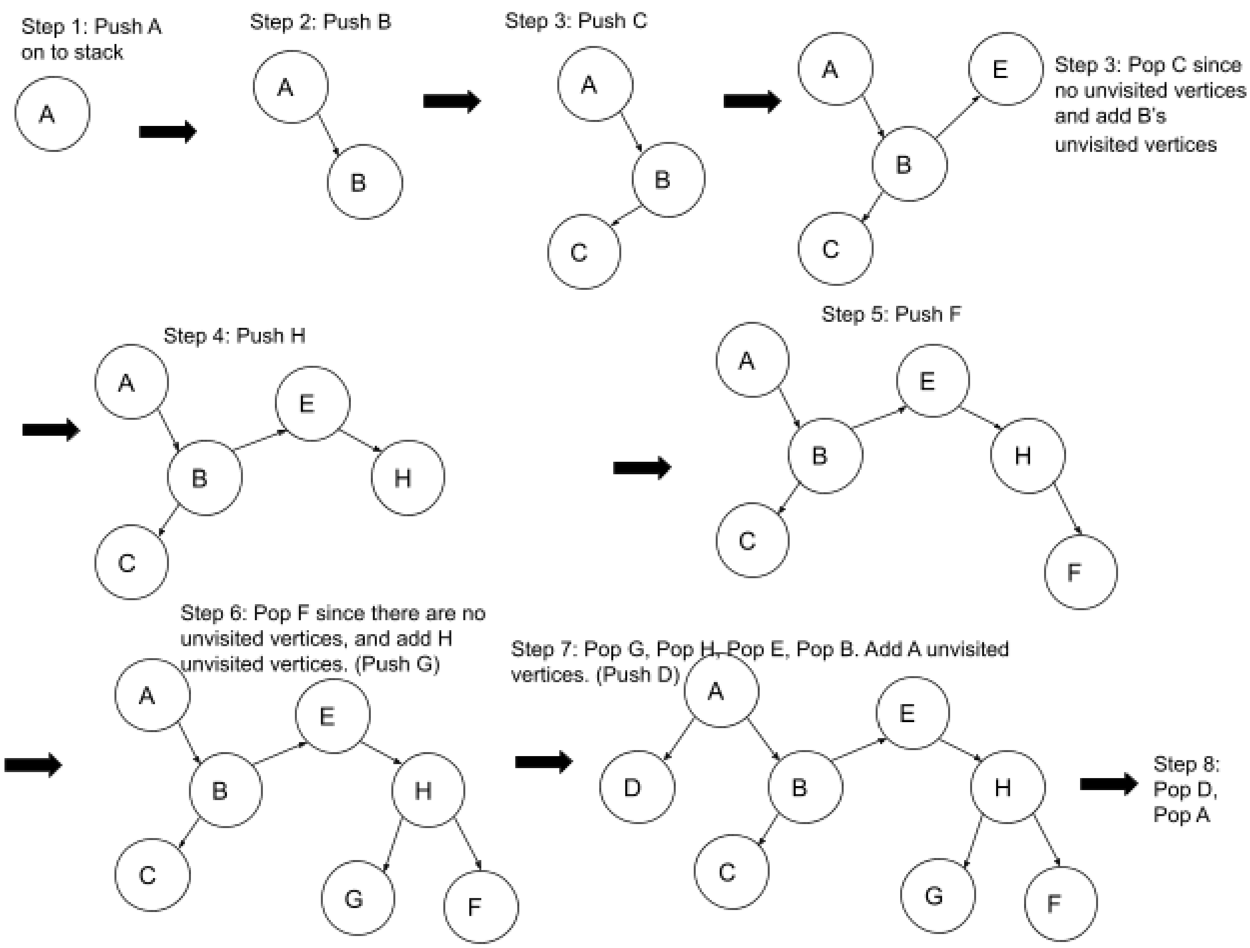
(c.1)In what order will the nodes be visited using a Breadth First Search starting from vertex A and using a queue ADT?

- Final BHS order: A, B, D, C, E, G, H, F



(c.2) In what order will the nodes be visited using a Depth First Search starting from vertex A and using a stack ADT?

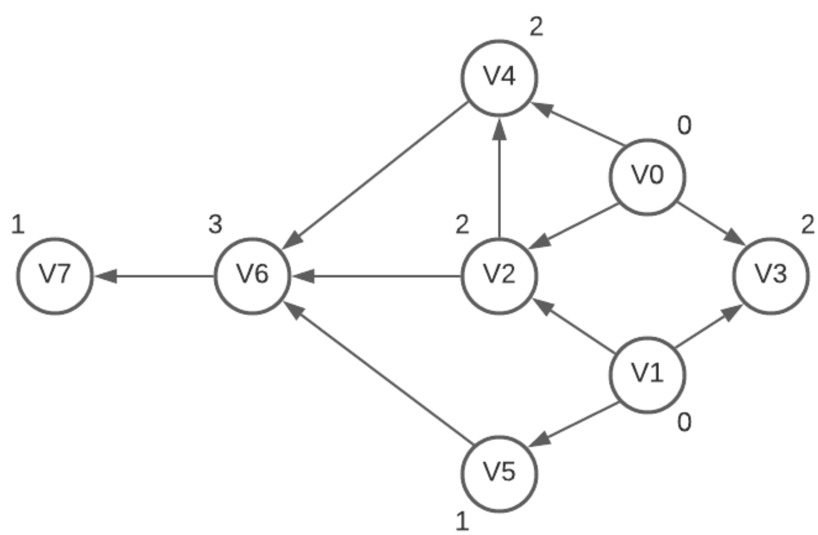
- Final DFS order: A, B, C, E, H, F, G, D



(d) Show the ordering of vertices produced by the topological sort algorithm given in class starting from vertex V1 when it is run on the following DAG (represented by its adjacency list, in-degree form). Justify.

V1, V5, V0, V3, V2, V4, V6, V7

V0	---
V1	---
V2	V0, V1
V3	V0, V1
V4	V0, V2
V5	V1
V6	V2, V4, V5
V7	V6



- Start at V1 with in-degree of 0, V5 in-degree is reduced to 0, V2 in-degree reduced to 1, V3 in-degree reduced to 1
- Move to V5, V6 in-degree is reduced to 2
- Move to V0, V4 in-degree is reduced to 1, V3 in-degree is reduced to 0, V2 in-degree is reduced to 0
- Move to V3, V3 have no child nodes so move to next node with in-degree of 0,
- Move to V2, V4 in-degree is reduced to 0, V6 in-degree is reduced to 1.
- Move to V4, V6 in-degree is reduced to 0
- Move to V6, V7 in-degree is reduced to 0
- Move to V7