CSCI 406: Algorithms
Solution to Assignment 6

5.1 graph G_1 only

(a) [5 pts] A-B-D-I-C-E-G-J-F-H

(b) [5 pts] A-B-C-E-D-G-H-F-J-I

5.4 [10 pts] BFS considers all vertices at a distance d from the source before it considers vertices at distance $d+1$. Consider a vertex v at distance d and its edge (v, w).

- Suppose w is an ancestor of v in the BF tree ((v, w) is a back edge). Since the graph is undirected, (w, v) would have been explored first. Either (w, v) is a tree edge or a cross edge.
- If w is a descendant of v (forward edge), w must be at level $d+1$ making (v, w) either a tree edge or a cross edge.

5.6 (a) [5 pts] a star-shaped graph where all nodes are connected to s. BFS will first discover all the nodes from s before any of them are processed.

(b) [5 pts] a chain of nodes with leftmost node s. DFS will move rightwards discovering nodes and placing them on the stack before it finishes processing them.

5.18 [10 pts] First we use the data to construct a graph. Each node represents a movie which will be played on either Saturday or Sunday night. Each edge represents the two movies a customer wishes to watch. We can then check if the graph is bipartite using the `twocolor` algorithm. If the graph can be colored using two colors, one of the colors will represent movies to be shown on Saturday night and the other color will represent movies to be shown on Sunday night.

5.30 [10 pts] Yes, every bridge e must be an edge in a depth-first search tree.
The subgraphs on either side of the bridge must be visited in the depth-first search. Assume it is possible to reach both sides without using the bridge. This means there is another edge connecting the two subgraphs on either side of the bridge. This contradicts the definition of a bridge. Therefore every bridge e must be an edge in a depth-first search tree.