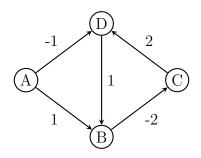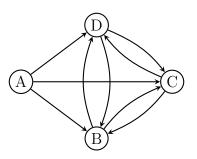# COMS21103: Problems set 7

All-pairs shortest paths

If any of the problems seems unclear, please post a question on the forum.

1. Run the Floyd-Warshall algorithm and Johnson's algorithm on the following graph.

2. Describe how to detect whether there is a negative-weight cycle in a directed graph in time $O(VE)$. Recall that Bellman-Ford detects a negative-weight cycle *reachable from the source.*

3. The *transitive closure* of a directed graph G is the graph G' which has the same set of vertices, and edges defined as follows: There is an edge $u \to v$ in G' whenever there is a path from u to v in G. For example, the transitive closure of the above graph is

Describe how to use the Floyd-Warshall algorithm to compute the transitive closure of a graph.