Multi-Agent Systems

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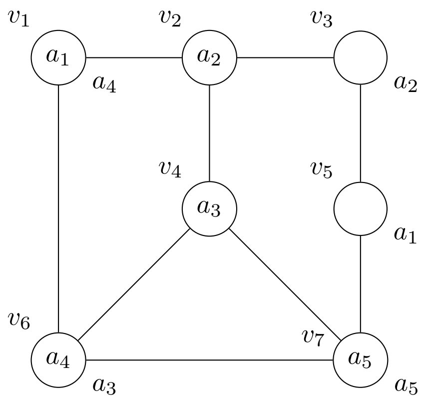
Exercise Sheet 8

Due: December 20, 2019

Exercise 8.1 (BIBOX, 1+2+1)

In this exercise, we will apply the BIBOX algorithm. Consider the following MAPF instance (the agent labels within the nodes represent the start configuration, the ones outside represent the goal configuration):



(a) Construct a loop decomposition for the graph, i.e. choose a basic cycle C_0 and add loops L_1, L_2. To avoid additional steps, choose a C_0 that includes both vertices which are empty in the goal configuration, i.e. v_2 and v_4.

(b) Fill the outer loops L_2 and L_1, starting with L_2. Move agents in the required order into each loop, which will require moving other agents out of the way. However, previously solved loops should not be disturbed.

(c) Finally, arrange C_0, which should contain the correct agents (and both empty vertices) at this point. If there are three or more agents in this circle, getting the agents in the correct order might require temporarily disturbing one of the adjacent loops.

For each step of the procedure, state the objectives and a corresponding sequence of agent moves to achieve it, e.g. "*move a_3 into L_3:* $a_5 : v_7 \to v_6, a_3 : v_4 \to v_7$". Since the algorithm on how to compute single agent paths is not specified explicitly, the chosen move sequence for each objective does neither have to be optimal nor adhere to a fixed strategy.

Exercise 8.2 (BIBOX vs. CA*, 2)

Unlike cooperative A*, BIBOX is complete (given that the graph is biconnected and that it contains at least two empty nodes). Construct a MAPF problem instance which is solvable by BIBOX but not by CA* (assuming CA* uses a fixed agent order).

Exercise 8.3 (Speech Acts, 2)

Using the ideas of Cohen and Perrault's plan-based theory of speech acts, as well as the semantics of FIPA's `request` and `inform` performatives, try to also give semantics to the FIPA performatives `agree` and `refuse`.