2 Artificial Intelligence (sbh11)

A *constraint satisfaction problem (CSP)* has four variables V_1, V_2, V_3, V_4, each with domain $\{1, 2\}$. The constraints for the problem require that given any three variables exactly one must have the value 1.

(*a*) Explain how this problem can be represented as a CSP that uses only binary constraints. Illustrate your answer by giving a graph representing the problem. [4 marks]

(*b*) Describe how *forward checking* can be used to aid the search for a solution to a CSP. Illustrate your answer by showing how it applies to the problem in Part (*a*), for assignments $V_1 = 1$ followed by $V_2 = 2$. [4 marks]

(*c*) Describe the *AC-3* algorithm for imposing consistency in a CSP. Include in your answer descriptions of an *arc*, what it means for an arc to be *consistent*, how a non-consistent arc can be made consistent, and the overall operation of the algorithm. [6 marks]

(*d*) Consider again the problem in Part (*a*). We initially have no assignments, and start by setting $V_1 = 1$. Explain in detail what happens if we attempt to adjust the domains to impose consistency. [6 marks]