

## COMP30024 Artificial Intelligence - Tutorial Problems (Part 3)

Questions based on exercises from Russell and Norvig (3rd edition) have the original question numbers shown in brackets. Many of these questions are designed to provoke discussion in tutorials, rather than having a simple, closed-form answer.

### 6. Constraint Satisfaction Problems

6.1 The N-Queens problem is a classic benchmark search problem. Given an  $N \times N$  chessboard, the aim is to place a total of  $N$  queen chess pieces on the board, so that no queen can capture any other queen.

- a. Choose a CSP formulation for this problem. In your formulation, what are the variables? What is the domain of values for each variable? What does the constraint graph look like?
- b. Can you write a formal specification of the constraints for this problem? Assume  $N = 4$ .
- c. How large is the state space if  $N = 4$ ?

6.2 (RN 6.9) Explain why it is a good heuristic to choose the variable that is *most* constrained but the value that is *least* constraining in a CSP search.

6.3 (RN 6.11) Use the AC-3 algorithm to show that arc consistency can detect the inconsistency of the partial assignment  $\{WA = \text{green}, V = \text{red}\}$  for the problem of colouring the map of Australia as shown in the lectures.

6.4 (RN 6.12) What is the worst-case complexity of running the AC-3 arc consistency algorithm on a **tree-structured CSP**, if  $E$  is the number of edges on the constraint graph, and  $D$  is the size of each domain?