Constraint Satisfaction Problems Tutorial

Problem 1:
Describe the following problem as a constraint satisfaction problem:

\[
\begin{align*}
S & \quad E & \quad N & \quad D \\
+ & \quad M & \quad O & \quad R & \quad E \\
\hline
M & \quad O & \quad N & \quad E & \quad Y
\end{align*}
\]

Draw a constraint graph.
Describe how to apply the following methods/heuristics:
- Forward checking
- Using the most constrained variable
- Using the most constraining variable
- Using the least constraining value
- Local search using min-conflict

Problem 2:
Use Forward Checking to show that the coloring problem for Australia does not have a solution for the following initial assignment \{WA = green, NT = red, V = red\}.

Problem 3:
Given the following CSP:

\[
\begin{array}{ccc}
\_ & \_ & \_ \\
\_ & \_ & \_ \\
\_ & \_ & \_ \\
\end{array}
\]

Assign a number in each cell such that
1. Numbers take value of 1 or 2
2. Sum of numbers on every row is odd.
3. Sum of numbers on every column is even
4. Sum of all numbers is greater than 6.

Please describe a starting state such that local search with min-conflicts gets stuck with local optimum. Explain how Simulated Annealing can escape local optimum to find a global optimum solution.