

[Minor II]

1. (a) The actual computation requires just one state, whose action is always the same: rewrite the current symbol to its complement and move right to the next symbol. This has to be repeated until the string ends, and no other action is needed. Hence the FSM needs just two states: one active state as mentioned, and one halt state to move to when the string ends.

1. (b) Let the states be $\{s_1, \textcircled{s_2}\}$, with s_2 being a halt state. The FSM transition function $f()$ is given by:

Current state	Current symbol	New state	New symbol	Move
s_1	0	s_1	1	R
s_1	1	s_1	0	R
s_1	' '	$\textcircled{s_2}$	' '	N

2. (a) The global DB needs to store the current state of the game. This involves the state of the grid, plus an indicator of whose turn it is. The state of the grid can be represented as a 9-D vector, with say '1' used for X, '2' used for O, and '0' used for an empty square. So for the given example grid state, the vector representation would be: $\{0, 2, 1, 2, 1, 1, 2, 0, 0\}$. In addition we can have a variable called 'NEXT'; NEXT=1 could denote that the player with symbol 1 (X) goes next, and NEXT=2 for the other player.

2. (b) Here are two possible rules (positions on grid numbered as in above example from 1 to 9):

wins game for '1' $\left[\begin{array}{l} \rightarrow \text{If position 1} = '1' \text{ and position } 7 = '0' \text{ and } 4 = '1' \text{ and } \text{NEXT} = 1, \text{ then} \\ \text{set position } 7 = '1' \text{ and } \text{NEXT} = 2 \end{array} \right.$

prevents possible win for '1' $\left[\begin{array}{l} \rightarrow \text{If position 1} = '1' \text{ and position } 4 = '1' \text{ and position } 7 = '0' \text{ and } \text{NEXT} = 2, \\ \text{then set position } 7 = '2' \text{ and } \text{NEXT} = 1 \end{array} \right.$

2. (c) The control structure will be the strategy used by the players to pick one of the applicable production rules at each turn. For example, each rule might have an associated probability of it winning you the game, based on forward reasoning or past experience. Then your strategy might be to pick the rule with the highest win probability, which is applicable to the current game state.