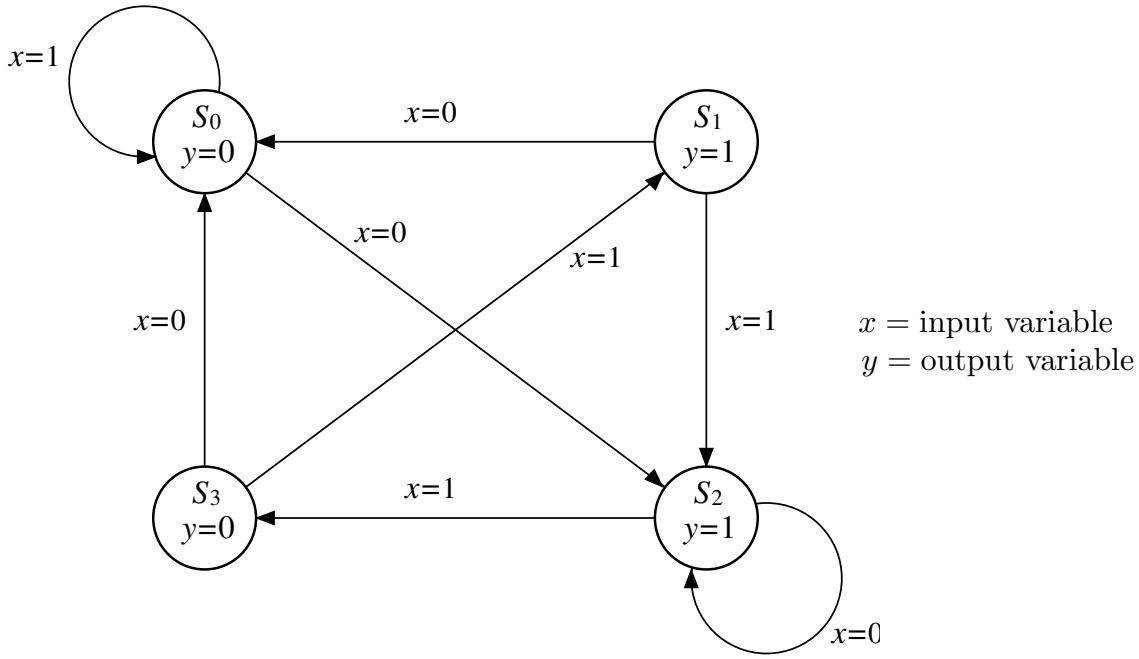
2007 Paper 2 Question 2

Digital Electronics

Consider the following state diagram



and the state assignment $S_0 = 00$, $S_1 = 01$, $S_2 = 10$ and $S_3 = 11$.

(a) Write down the state table and derive the minimised Boolean expressions for implementing the next-state and output functions. Assume the use of D-type flip-flops for the state registers. Note that state $= (Q_1, Q_0)$. [10 marks]

(b) An alternative is to use a 1-hot state machine with the following state assignment: $S_0 = 0001$, $S_1 = 1000$, $S_2 = 0010$ and $S_3 = 0100$. Determine Boolean expressions for implementing the next-state and output functions assuming the use of D-type flip-flops. Note that state $= (Q_3, Q_2, Q_1, Q_0)$. [7 marks]

(c) What problem may arise with the approach proposed in part (b)? Briefly describe *two* solutions to this problem. [3 marks]