EIE 211 Logic Design - Tutorial 5

Q1. Derive the input equations, the output equation, the state table and the state diagram of the following circuit.

Q2. You are requested to design a sequential logic circuit with D flip-flops for a system whose state diagram is given as below.

(a) Determine the following parameters of the system to be realized: Number of states, number of system inputs, and number of system outputs.
(b) Derive the corresponding state table for the system.
(c) How many Flip Flops are required to construct this system?
(d) Derive the input equations and the output equations of the system.
(e) Design the circuit and draw a circuit diagram to show your design. You can only use D Flip-Flops, AND, OR and NOT gates in your design.
(f) How many unused states are there in the system?
(g) Theoretically, the system output values and the next state values for unused states are don’t care. Is it really true that we can assign any binary value (0 or 1) to the output values and the next-state values of these unused states? Why?
(h) State 10 is an unused state of the system. Suppose I assign its next-state values as follows. Is it acceptable?

<table>
<thead>
<tr>
<th>p.state</th>
<th>i/p</th>
<th>n. state</th>
<th>o/p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A B X</td>
<td>D_A D_B Q</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 0 0</td>
<td>1 0 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 0 1</td>
<td>1 0 1</td>
<td></td>
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</tr>
</tbody>
</table>

Value assignment for an unused state
Q3. Port the following 2 Boolean functions to the 3 programmable logic devices shown in Fig. Q3 by marking the closed connections in their internal structures.

(i) \( X(A,B,C) = BC + AB \)

(ii) \( Y(A,B,C) = BC + \overline{AB} + \overline{AC} \)