**Additional Problems (Graded)**

1. Complete the timing diagram for the circuit in Figure 1. ***(6)***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | t0 | t1 | t2 | t3 | t4 | t5 | t6 | t7 | t8 | t9 | t10 | t11 | t12 | t13 | t14 | t15 | t16 | t17 | t18 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| clk |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Qa |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Qb |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Qc |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1. Draw the state diagram for a machine that can recognize the input sequences 010 and 111. Assume that the output is valid on the next clock edge. ***(10)***

W=1

w

w=1

W=1

W=1

W=1

W=0

W=0

W=0

W=0

W=1

W=1

W=0

W=0

W=0

1. Provide the state assignment table for your diagram from (2). ***(6)***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PS | | NS | | z |
| w = 0 | w = 1 |
|  | y­­2 y1 y0 | Y2 Y1 Y0 | Y2 Y1 Y0 |
| A | 000 | 100 | 001 | 0 |
| B | 001 | 100 | 010 | 0 |
| C | 010 | 100 | 011 | 0 |
| D | 011 | 100 | 011 | 1 |
| E | 100 | 100 | 101 | 0 |
| F | 101 | 110 | 010 | 0 |
| G | 110 | 100 | 101 | 1 |
| H | 111 | ddd | ddd | d |

1. Using the state table below, give the equation for *z* and *Y0*. Assume sequential encoding and DFFs. Show all of your work. ***(10)***

Y0 = w`[y1’ y0 + y1y0] + w[y1y0’]

= w’[y0(y1+y1’)] + wy1y0’

= w’[y0(1)] + wy1y0’

= w’y0 + wy1y0’

z = w’[y1y0’] + w[y1’y0 + y1y0’ + y1y0]

= w’y1y0’ + w[y1’y0 + y1(y0’ + y0)]

= w’y1y0’ + w[y1’y0 + y1(1)]

= w’y1y0’ + w[y1’y0 + y1]

= w’y1y0’ + w(y1 + y0)