Faculty of Engineering
School of Electrical Engineering
and Computer Science
*CEG2136 Computer Architecture I*

uOttawa

**NAME / Student ID#**

SECTION: A

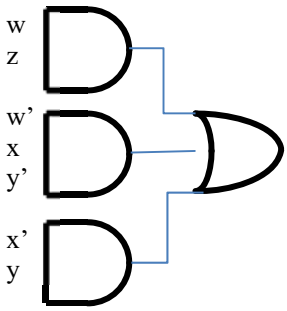
**Quiz 1**
**2019**
**Even**

## Question 1

1. Represent F(w, x, y, z) = Σm( 2, 3, 4, 5, 13, 15) + dc(8, 9, 10, 11) on a 4 variable K-map

| wx \ yz | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 0 | 1* | 1* |
| 01 | 1* | 1 | 0 | 0 |
| 11 | 0 | 1 | 1* | 0 |
| 10 | d | d | d | d |

2. Write down the list of the function's prime implicants (PI) and the list of the essential prime implicants (EPI).
   PI: wz, w'xy', xy'z, x'y  EPI: wz, w'xy', x'y
3. Find the minimum expression in a sum-of-products form of the logic function.
   f(a,b,c,d) = wz + w'xy' + x'y
   Is your solution unique? YES,
   Justify your answer.
   $f_{min}$ is composed of EPI's only
4. Draw the logic diagram using AND and OR gates.
5. Redraw the logic diagram using NAND gates




## Question 2

. 1. Give the characteristic tables of the SR flip-flop and of the T flip-flop

**SR FF**

| S | R | $Q^n$ | $Q^{n+1}$ |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | Forbidden |
| 1 | 1 | 1 | non-sense |

or:

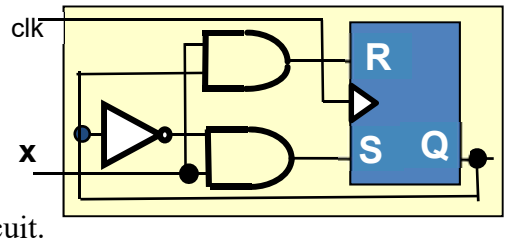
| S | R | $Q^{n+1}$ | *Function* |
|---|---|---|---|
| 0 | 0 | $Q^n$ | Hold |
| 0 | 1 | 0 | Reset |
| 1 | 0 | 1 | Set |
| 1 | 1 | ?? | Forbidden |

**SR FF**

| T | $Q^{n+1}$ | *Function* |
|---|---|---|
| 0 | $Q^n$ | *Hold* |
| 1 | $(Q^n)'$ | *Toggle* |

| T | $Q^n$ | $Q^{n+1}$ |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

2. Analyze the next sequential circuit and address the following questions:




a) Find the equations of the S and R inputs of the SR flip-flop:
   **S=xQ'** **R=xQ**.

b) Use these equations to derive the state table of the sequential circuit.

| x | $Q^n$ | S | R | $Q^{n+1}$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 |

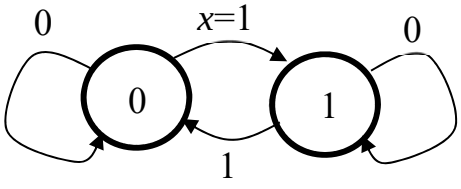
or:

| x | $Q^n$ | $Q^{n+1}$ |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

or:

| $Q^n$ | x | S | R | $Q^{n+1}$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 |

c) Draw the state diagram of the circuit.




d) What type of flip-flop is implemented by this sequential circuit? *T FF with x=T*