Dec 10 2024 Comp-2650 Final

Names: Trésor Dan
Minor NGABIRAND

ID: 11018207 8

1(a) Distributivity: refers to the expansion of boolean expressions that help us factorize or simplify boolean expressions. An example is $x(y+z) = xy + xz$

(b) Duality: refers to when there exists a boolean relationship that was derived from another boolean relationship. A good example is De Morgan's law, which states that $(y+x)' = y'x'$ or another example is

$$A + A\overline{B} = A.$$

(c) Don't care Conditions: refers to when we use the blank cells of a K-map to make a group. We can also use them in Code converters. An example is in 4-bit BCD-to-XS-3 converter, the input combinations 1010, 1011, 1100, 1101, 1110 and 1111 are don't cares"

(d) A latch is a level-triggered device, therefore the output changes when the input changes. They are basic circuits that implements memory and time.

While

A flip-flop is an edge-triggered device, therefore its state only changes when a control signal goes from low to high or high to low. Flip-flops are a type of latch can store and recall a single bit of information.

All in all, their main difference is how they are triggered.

(e) The main difference between combinational and sequential logic circuit is whether they store past inputs

-> Combinational circuits produce outputs based on current inputs only, and do not store past inputs. They are time-independent meaning they

don't rely on clock pulses or feedback. Examples are multiplexers, encoders, decoders

While

Sequential circuits: produce outputs based on both the current and previous inputs and use memory to store past inputs. They are time - dependent. Examples inc lude counters, flip-flops

(f) Clock: refers to a timing device that generates a train of pulses. or it could be referred to as an internal timing device

(g) level-triggered means that the flip flop accepts the input depending upon input while

Edge-triggered Memory cell changes the flip flop condition at rising edges or falling edges.

② Four variable input k-map.

WZ \ YX	00	01	11	10
00		1	1	
01		1	1	
11	0	0	0	0
10	1			0

Product of sum (Pos)

$F = \Sigma(1,3,5,7,8) + d(10,12,13,14,15)$

$\Sigma(1,3,5,7,8) = \bar{Y}X\bar{W}\bar{Z} + YX\bar{W}\bar{Z} + \bar{Y}X\bar{W}Z + YX\bar{W}Z + \bar{Y}\bar{X}W\bar{Z}$

$d(10,12,13,14,15) = \bar{Y}\bar{X}WZ + \bar{Y}XWZ + Y\bar{X}WZ + Y\bar{X}W\bar{Z}$

Therefore, since the highlight ones are complement of of each other.

$F = YX\bar{W}Z + \bar{Y}\bar{X}W\bar{Z} + \bar{Y}XWZ$

$= \bar{Y}XW$

③ $F = \Sigma(1,3,5,7,8) + d(10,12,13,14,15)$

$\Sigma(1,3,5,7,8) = \bar{Y}X\bar{W}\bar{Z} + YX\bar{W}\bar{Z} + \bar{Y}X\bar{W}Z + YX\bar{W}Z + \bar{Y}\bar{X}W\bar{Z}$

+

$d(10,12,13,14,15) = \bar{Y}\bar{X}WZ + \bar{Y}XWZ + Y\bar{X}WZ + Y\bar{X}W\bar{Z}$

The highlighted text means that they are complements of each other (i.e $Y + \bar{Y} = 1$), so

$F = \bar{Y}XWZ + 1$

$= 1$ since identity element $= 1$

4 (a)