Test 2 18/19

Sunday, 17 December 2023 10:27 PM

Copy of Test 2 SCSR101...

UTM UNIVERSITI TEKNOLOGI MALAYSIA — School of Computing

RESEARCH UNIVERSITY

TEST 2 SEMESTER I 2018/2019

COURSE CODE	:	**SCSR1013**
COURSE TITLE	:	**DIGITAL LOGIC**
PROGRAM	:	**SCSR/SCSJ/SCSB/SCSV/SCSP**
TOTAL TIME	:	**2 HOUR 15 MINUTES**
DATE	:	**23 / 11 / 2018**
VENUE	:	**L50 & N24**

(GENERAL INSTRUCTION):

Answer all questions.

Write ALL your answers in the answer booklet.

Show all your works.

This test will contribute 25% towards the total marks of 100%.

Warning!

Students who are caught cheating during the examination will be reported to the disciplinary board for possible suspension of the student for one or two semesters.

Name	
Metric No	
Year / Course	
Section (Circle)	**01 / 02 / 03 / 04 / 05 / 06 / 07 / 08 / 09 / 10**
Lecturer (Circle)	**Mr Firoz / Ms Marina / Dr Mazura / Dr Mohd Foad Mr Muhalim / Dr Raja Zahilah / Mrs Rashidah**

This question booklet consists of 4 pages including the front page.

QUESTION 1 [10 MARKS]

a) Based on XNOR logical expression of $X = AB + \bar{A}\bar{B}$,

(i) [3m] Prove that the expression X can be derived from $\overline{\bar{A}\bar{B} + AB}$

(ii) [3m] Draw the logic circuit, X

b) [4m] Simplify the expression $Z = (\bar{A} + B)(A + B + D)\bar{D}$

QUESTION 2 [10 MARKS]

From the expression, $Y = ABC + D$

a) [4m] Get the standard SOP expression for Y using Boolean Algebra rules.

b) [3m] Generate the truth table for Y.

c) [3m] Get the standard POS expression from the truth table.

QUESTION 3 [10 MARKS]

The figure below showed the K-Map for equation Y.

AB\CD	00	01	11	10
00	0	1	1	0
01	X	X	X	X
11	0	1	1	0
10	X	X	X	X

a) [4m] Write the equations by using *Sigma* and *Pi* notations including the *don't care* term for both SOP and POS expressions.

b) [4m] Find the simplified SOP and POS equations.

c) [2m] From your answer in question 3(b), when ABCD = 0101, is Y value equivalent to the above K-Map? Why?

1a(i) $\overline{\bar{A}\bar{B} + \bar{A}\bar{B}}$

$= \overline{\bar{A}\bar{B}} \cdot \overline{\bar{A}\bar{B}}$

$= (\bar{\bar{A}} + \bar{\bar{B}})(\bar{\bar{A}} + \bar{\bar{B}})$

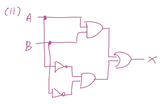
$= (\bar{A} + B)(A + \bar{B})$

$= \bar{A}A + \bar{A}\bar{B} + AB + B\bar{B}$

$= 0 + \bar{A}\bar{B} + AB + 0$

$= \bar{A}\bar{B} + AB$

(ii)



b) $Z = (\bar{A} + B)(A + B + D)\bar{D}$

$= (\bar{A}A + \bar{A}B + \bar{A}D + AB + BB + BD)\bar{D}$

$= (0 + \bar{A}B + \bar{A}D + AB + B + BD)\bar{D}$

$= \bar{A}B\bar{D} + \bar{A}D\bar{D} + AB\bar{D} + B\bar{D} + BD\bar{D}$

$= \bar{A}B\bar{D} + 0 + AB\bar{D} + B\bar{D} + 0$

$= \bar{A}B\bar{D} + B\bar{D}$

$= B\bar{D}$

2a) $Y = ABC + D$

$= ABC(D + \bar{D}) + (A + \bar{A})(B + \bar{B})(C + \bar{C})D$

$= ABCD + ABC\bar{D} + (AB + A\bar{B} + \bar{A}B + \bar{A}\bar{B})(CD + \bar{C}D)$

$= ABCD + ABC\bar{D} + \cancel{ABCD} + AB\bar{C}D + A\bar{B}CD + A\bar{B}\bar{C}D + \bar{A}BCD + \bar{A}B\bar{C}D + \bar{A}\bar{B}CD + \bar{A}\bar{B}\bar{C}D$

b)

A	B	C	D	Truth value
1	1	1	1	1
1	1	1	0	0
1	1	0	1	1
1	0	1	1	1
0	1	1	1	1
1	1	0	0	0
1	0	1	0	0
0	1	1	0	0
1	0	0	1	1
0	1	0	1	1
0	0	1	1	1
1	0	0	0	0
0	1	0	0	0
0	0	1	0	0
0	0	0	1	1
0	0	0	0	0
A	B	C	D	

c) POS = $\bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}CD + \bar{A}B\bar{C}D + A\bar{B}\bar{C}D + \bar{A}BCD + A\bar{B}CD + AB\bar{C}D + ABCD$

QUESTION 4 [15 MARKS]

For each of the K-Maps, writes its simplified SOP equations. Assume the output for all K-Maps is Y.

(a) [3m]

AB\CD	00	01	11	10
00	1	X	X	0
01	X	0	0	X
11	0	0	0	0
10	X	0	1	X

$\bar{A}\bar{C}D + \bar{A}BC$

(b) [3m]

AB\CD	00	01	11	10
00	1	0	X	1
01	0	0	0	0
11	0	0	0	0
10	X	0	X	X

$\bar{B}\bar{D}$

(c) [6m]

AB\CD	00	01	11	10
00	0	1	0	1
01	1	0	1	0
11	0	1	0	1
10	1	0	1	0

(d) [3m]

AB\CD	00	01	11	10
00	0	X	X	0
01	0	1	X	0
11	1	X	X	0
10	0	1	0	0

$ZD + AB\bar{C}$

QUESTION 5 [15 MARKS]

a) [5m] Show the results of the following circuit with a truth table. You must include output of ALL gates. Assume the output is Y.

$\bar{A}\bar{C} + \bar{B} + \bar{C}$

$AB + \bar{C}$

$= \overline{\overline{AB}\,\bar{C}} + \bar{B} + \bar{C}$

$= \overline{(\bar{A} + \bar{B})\bar{C}} + \bar{B} + \bar{C}$

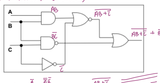
$= \bar{A}\bar{C} + \bar{B}\bar{C} + \bar{B} + \bar{C}$

$\bar{A}\bar{C} + \bar{B} + \bar{C}$

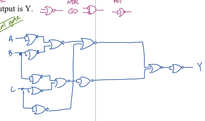
A	B	C	$\bar{C}$	AB	AB+$\bar{C}$	$\overline{AB+\bar{C}}$	BC	$\bar{B}\bar{C}$	$\overline{AB+\bar{C}} + \bar{B}\bar{C}$
0	0	0	1	0	1	0	0	1	1
0	0	1	0	0	0	1	0	1	1
0	1	0	1	0	1	0	0	1	1
1	0	0	1	0	1	0	0	1	1
0	1	1	0	0	0	1	1	0	1
1	0	1	0	0	0	1	0	1	1
1	1	0	1	1	1	0	0	1	1
1	1	1	0	1	1	0	1	0	0

b) [5m] Convert the circuit using NOR universal gates ONLY. Assume the output is Y.

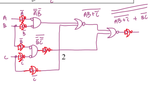
basic → universal (+ overall)



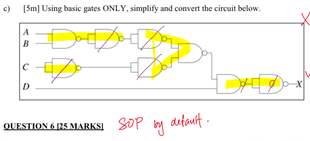
universal gate

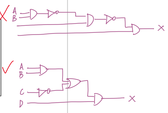


Bool Equation



c) [5m] Using basic gates ONLY, simplify and convert the circuit below.





QUESTION 6 [25 MARKS] SOP by default.

The orientation for selected new students will be conducted in two halls, L50 and N24. The student's selection is based on:

- the first alphabet of their matric card, representing either first year or direct entry students.
- the last decimal digit of the matric card number represented by 3 binary bits.

000
001
010
011
100
101
110
X 111

The rules of entering the halls will be determined by the following rules:

1. Students cannot have number 7 as the last decimal digit of their matric card number.
2. Students enter L50 if they are first year student with ODD matric number and direct entry students with EVEN matric number.
3. Students from room L50 will have a second session in N24 if the first two bits of the decimal digit are equals.

Design a combinational logic circuit to determine which hall(s) the students should enter. You may use any gates you want.

output - L50 = L
- N24 = N

input - first year = F
- direct entry = D
- odd
- even