CONFIDENTIAL

UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Faculty of Computing

TEST 2

SEMESTER I 2016/2017

SUBJECT CODE	:	SCSR 1013
SUBJECT TITLE	:	DIGITAL LOGIC
DATE	:	18 November 2016
TIME/DURATION	:	9:00am – 11:00am [2 HOURS]
VENUE	:	Exam Hall P16, FKE
MARKS/PERCENTAGE	:	75 MARKS [25%]

INSTRUCTIONS TO CANDIDATES:

1. There are 7 questions. Answer **ALL** questions in the answer booklet, EXCEPT
2. Answer question 1 (c) in the Appendix and insert the Appendix inside your answer booklet.

Name			
Matric No.			
Year/Course		**Section**	
Lecturer (CIRCLE)	ISMAIL FAUZI | MARINA | MOHD FO'AD MUHALIM | RAJA ZAHILAH | RASHIDAH		

This questions paper consists of (3) printed pages front and back, EXCLUDING this page.

1. **[10 MARKS]** Using 2 inputs, A and B and 1 output, X,

   a) Write the Boolean expressions X for NAND and NOR gates. [2m]

   b) Construct the truth table for NAND and NOR gates. [4m]

   c) Complete the NAND Timing Diagram in Appendix A. [4m]

2. **[8 MARKS]** Simplify the Boolean expression:

   a) $Z = (\bar{A} + B)(A + B)$ using Boolean Algebra Rules. [4m]

   b) $Z = \overline{(A\bar{B} + C)}\bar{D}$ using DeMorgan's theorems. [4m]

3. **[7 MARKS]** For Boolean expression $Y = AB(\overline{CD})$,

   a) Construct the corresponding logic circuit using two-input basic gates only. [3m]

   b) Construct the complete truth table. [4m]

4. **[10 MARKS]** A Boolean expression is written in the following notation:

$$X = \prod_{ABC}(1, 5, 7)$$

   a) Write the equivalent Boolean expression standard form. [2m]

   b) Construct the truth table for *X*. [4m]

   c) Use K-Map to produce the simplified POS expression of *X*. [4m]

5. **[6 MARKS]** Given an expression of $Y = \sum_{ABCD}(0,2,7,8,11,13,14) + d(3,6,10,15)$, generate the simplified SOP expression using K-Map.

6. [9 MARKS] WITHOUT using Rules of Boolean Algebra or DeMorgan's Theorem and:

a) Using only NOR gates, convert and simplify the circuit in Figure 1. [4m]

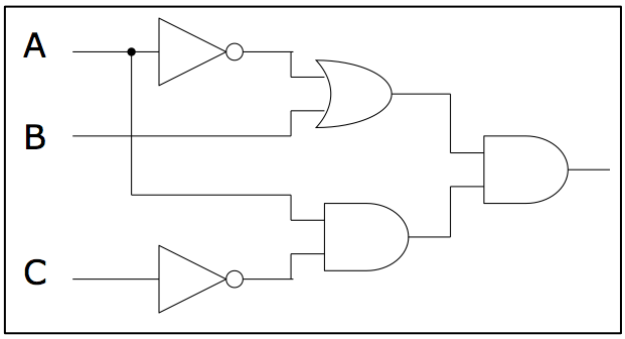

Figure 1: NOR gates circuit

b) Using only basic gates, simplify and convert the circuit in Figure 2. [5m]

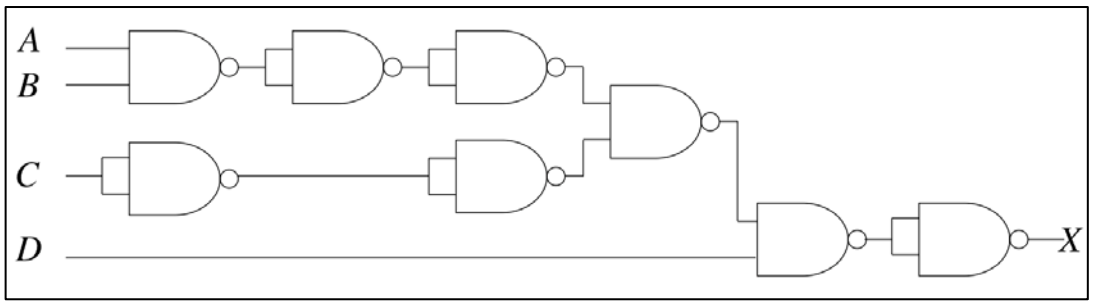

Figure 2: NAND gates circuit

7. **[25 MARKS]** A shop wants to have a special sale where the customers would get a discounts of 20% and vouchers if they shop on special days, with the following terms:

- Regular customers will get a discount when they shop on a weekend.
- Staff members will get the discount if they shop at the end of the month.
- Both types of customers will get additional voucher if their discount day falls on a public holiday.
- In that year, there does not exist a day where all three events (weekend, end of the month and public holiday) falls on that day.

[*Sebuah kedai ingin mengadakan jualan istimewa untuk pelanggannya dengan memberikan diskaun 20% dan baucer pada hari tertentu dengan syarat-syarat berikut:*

- *Pelanggan biasa akan mendapat diskaun jika mereka membeli-belah pada hujung minggu.*
- *Pekerja akan mendapat diskaun jika mereka membeli-belah pada hujung bulan.*
- *Kedua-dua pelanggan biasa dan pekerja akan mendapat tambahan baucer jika hari diskaun mereka jatuh pada cuti umum.*
- *Pada tahun itu tidak wujud hari di mana-mana ketiga-tiga peristiwa (hujung minggu, hujung bulan dan cuti umum) jatuh pada hari tersebut.*

(a) Design a combinational logic circuit for cashier machines in the shop to determine when the customers would receive the discount and vouchers.
[Hint: there are four inputs and two outputs variables.]

(b) Implement the circuit using NAND universal gates only. (There are no limit to the number of input wires you want to use).

APPENDIX A

ANSWER FOR QUESTION 1(c)

Name : _____

Matric No. : _____

Section : _____

Lecturer : _____