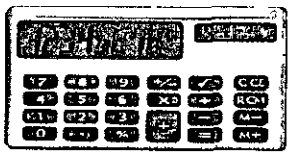
UNIVERSITY EXAMINATIONS



UNIVERSITEITSEKSAMENS

UNISA university of south africa

DIG1501

October/November 2017

DIGITAL SYSTEMS I (THEORY)

Duration 3 Hours

100 Marks

EXAMINERS

FIRST MR JA NIEUWOUDT
SECOND MR NR NETSHIKWETA

Programmable pocket calculator is permissible

Closed book examination

This examination question paper consists of 6 pages including the cover page plus 1 page answer sheet

Submit answer sheet with your examination script

Answer all the questions

PLEASE NOTE IF YOU HAVE THE OPINION THAT INSUFFICIENT INFORMATION IS SUPPLIED FOR YOU TO ANSWER A PARTICULAR QUESTION, MAKE A REALISTIC ASSUMPTION, MOTIVATE IT AND THEN ANSWER THE QUESTION

QUESTION 1

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1 1 On a digital waveform, the transition time from a LOW level to a HIGH level is called

A) period B) pulse width C) fall time D) rise time____ (1)

1 2 Which edge in Figure 1-1 is the leading edge?

Figure 1-1

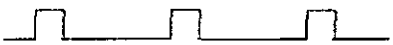
A) 1 B) 2 C) 3 D) Both 1 and 3 (1)

1 3 Which edge in Figure 1-1 is the trailing edge?
A) 1 B) 2 C) 3 D) Both 1 and 3 (1)

1 4 The time between transition 1 and transition 3 in Figure 1-1 is the ___

A) period B) pulse width C) amplitude D) frequency (1)

1 5 The approximate **duty cycle** for the digital waveform below is (1)



A) 30% B) 80% C) 20% D) 50% (1)

1 6 Which circuit converts data from serial form to parallel form? (1)

A) Comparator B) Demultiplexer C) Encoder D) Multiplexer (1)

1 7 Perform the following binary values subtraction

1100 - 0111 = _____

A) 101 B) 11110 C) 110 D) 010 (1)

1 8 The 2's complement of binary 110110 is _____

A) 110100 B) 001010 C) 001001 D) 101010 (1)

1 9 The highest single digit value in the octal number system is _____
A) 1 B) 7 C) 9 D) 8 (1)

1 10 Which of the following is an invalid BCD code?

A) 1101 B) 0011 C) 0101 D) 1001 (1)

1 11 Which of the following is the most widely used code for computer keyboard?

A) Gray B) parity C) ASCII D) EBCDIC (1)

1 12 What is the BCD form of 438 in odd parity?

A) 1000001101000 B) 1010000111000 C) 0100000110100
D) 0100001110001 (1)

1 13 The Hamming code is a(n) _____

A) encryption code B) an updated version of the ASCII code
C) error correction code D) octal version of the BCD code (1)

1 14 Which of these truth tables represents the Exclusive-NOR gate?

A	B	X
0	0	1
0	1	0
1	0	0
1	1	1

(A)

A	B	X
0	0	1
0	1	1
1	0	1
1	1	0

(B)

A	B	X
0	0	0
0	1	1
1	0	1
1	1	0

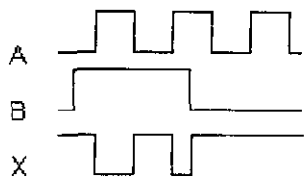
(C)

A	B	X
0	0	1
0	1	0
1	0	0
1	1	0

(D)

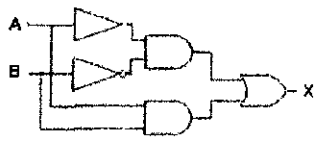
A) (A) B) (B) C) (C) D) (D) (1)

1 15 This is the timing diagram for a 2-input _____ gate



A) AND B) Exclusive-OR C) OR D) NAND (1)

1.16 What type of logic circuit is represented by Figure 2-1?



A) XAND B) XNOR C) XOR D) XNAND (1)

1 17 The symbol in Figure 3-1 *represents a(n)* _____ (1)

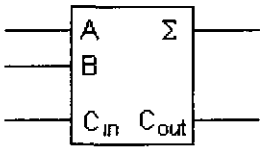


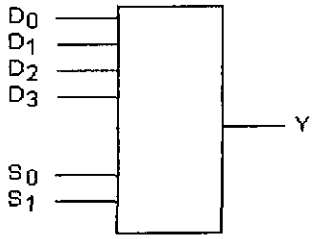
Figure 3-1

A) PLD B) Full-adder C) Half-adder D) And function (1)

1 18 Refer to the symbol in Figure 3-1. What are the output when A = 1, B = 1, C_{in} = 1?

A) Σ = 0, C_{out} = 1 B) Σ = 0, C_{out} = 0 C) Σ = 1, C_{out} = 0
D) Σ =1, C_{out} = 1 (1)

1 19 The symbol below is most likely a _____



A) multiplexer B) demultiplexer C) full-adder D) comparator (1)

[19]

QUESTION 2

2 1 Using Binary multiplication, multiply 5.7_8 and 22_{10} and give your answer in Hexadecimal. (5)

2.2 Do the following subtraction using the 2's compliment method: 72_{16} - $4F_{16}$.(Answer in Decimal) (4)

2 3 By first converting to Binary, calculate $9E\ 2_{16} - 8_{16}$. Give the final answer in Octal. (5)

2 4 Do the following addition in signed binary using the 2's complement method.

$31_8 + (-40_8)$ (6)
[20]

QUESTION 3

1.1 Define the term multiplexer Give its truth table and then draw a 4 to 1 multiplexer.. (10)

[TURN OVER]

3 2 Draw a logic symbol and give the truth table for a full adder (6)

3 3 The ASCII letter G is 1000111 Show the parity bit for the letter G with
3 3 1 odd parity (2)
3 3 2 even parity (2)

3 4 Define the function of a comparator how it could test two 4-bit numbers for equality? Draw the logic diagram to explain your answer. (5)
[25]

QUESTION 4

4 1 Refer to figure 1 and give the logic expression for the circuit. (3)

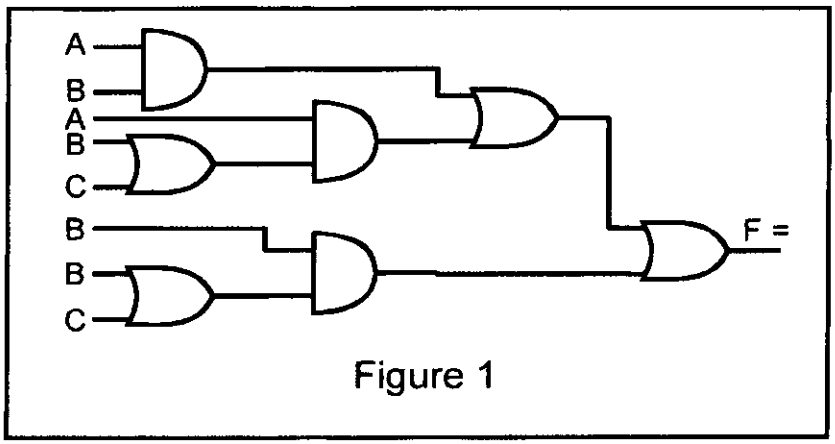


Figure 1

4 2 Simplify the expression obtained in 4 1 by use of Boolean Algebra. (5)

[8]

QUESTION 5

5 1 Simplify the following expression using the laws of Boolean Algebra·

$Y = \overline{A}\,\overline{B}\,\overline{C}D + \overline{A}B\overline{C}D + \overline{A}B\overline{C}\,\overline{D} + AB\overline{C}D + A\overline{B}\,\overline{C}D$ (5)

5 2 Draw a circuit for the following expression·

$F = \overline{[\overline{WX} + (X + \overline{Y})\overline{Z}][WZ + \overline{X}]}$ (5)

[10]

QUESTION 6 (Use the answer sheet provided)

South African Breweries (SAB) are having a problem of bottling The problem is the operator keeps falling asleep and if a fault occurs thousands of liters are wasted S A B. would like you to build a circuit that will set off an alarm and wake up the operator should a fault occur

There are four T T L compatible sensors in the bottling plant which do the following

Sensor A: Detects if the filling tap is on
("1" tap on, "0" tap off)

Sensor B Detects if a bottle has a cap on
("0" = no cap, "1" = cap on)

Sensor C. Detects if the bottle is full.
("0" = empty, "1" = full)

Sensor D. Detects if a bottle is being moved on the conveyer belt
("0" = stationary, "1" = moving)

The alarm should sound (logic "1" output) if any of the following conditions occur ·

1 A bottle is full but the tap is still on

2 A bottle has a cap on and the tap is on

3 If a bottle is empty and has a cap on

4 The bottle is being moved on the conveyer belt when the tap is on

Design a circuit using the table and Karnaugh map to draw a logic **diagram on the answer sheet** which meets these requirements **and hand in the answer sheet with your examination script..** **[18]**

TOTAL 100

ANSWER SHEET Student No_____

Question 6

Name: _____

Student No : _____

Sensor 1 A	Sensor 2 B	Sensor 3 C	Sensor 4 D	F

F

CD \ AB	00	01	11	10
00				
01				
11				
10				

Logic Diagram