



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

LOGIC SYSTEMS N3

9 April 2020

This marking guideline consists of 7 pages.

✓ = 1 mark √ = ½ mark

QUESTION 1: NUMBER SYSTEMS

1.1 $EF, F_{16} + 37, 3_8 + 11101101, 1011_2$

$EF, F_{16} = 11101111, 1111_2 \quad \checkmark$

$37, 3_8 = 011111, 011_2 \quad \checkmark$

$$\begin{array}{r}
 11101111, 1111 \\
 00011111, 0110 \quad \checkmark \\
 + \underline{11101111, 1111} \\
 11111101, 0000 \quad \checkmark
 \end{array}$$

$11111101, 0000 = 775, 0_8 \quad \checkmark$

(5)

1.2 $36, 25_{10} \times 3, 4_8$

$36, 25_{10} = 100100, 01_2 \quad \checkmark$

$3, 4_8 = 011, 100_2 \quad \checkmark$

$$\begin{array}{r}
 100100, 01 \\
 \times \quad 11, 10 \\
 \hline
 100100010 \checkmark \\
 1001000100 \\
 + \quad 10010001000 \checkmark \\
 \hline
 1111110, 1110 \quad \checkmark
 \end{array}$$

$1111110, 1110 = 7E, E_{16} \checkmark$

(5)

1.3 $B, C_{16} - 4, 5_8$

$$B, C_{16} = 1011, 11000110_2 \quad \checkmark$$

$$4, 5_8 = 100, 101_2 \quad \checkmark$$

$$\begin{array}{r} 1011, 11000110 \\ 1c \quad 1011, 01011111 \quad \checkmark \\ 10111, 00100101 \\ + \quad \quad \quad 1 \quad \checkmark \\ \hline 111, 00100110 \end{array}$$

$$111, 00100110 = 7, 116_8 \quad \checkmark$$

(5)

1.4 $112, 75_{10} \div 5, 4_8$

$$112, 75_{10} = 1110000, 11_2$$

$$5, 4_8 = 101, 100_2$$

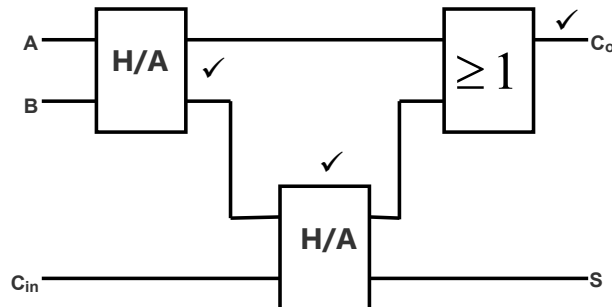
$$\begin{array}{r} 10100, 1 \checkmark \\ 1011 \overline{) 11100001, 1} \\ \underline{-1011} \checkmark \\ 1100 \\ \underline{-1011} \checkmark \\ 1011 \\ \underline{-1011} \checkmark \end{array}$$

$$10100, 1 = 20, 5_{10} \checkmark$$

(5)
[20]

QUESTION 2: CODES, DATA AND DATA COMMUNICATION, ENCODERS, DECODERS AND ARITHMETIC ELEMENTS

2.1



A	B	C _{in}	S	C _o
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

(6)

- 2.2 (010 0111✓
 F 100 0110✓
 6 011 0110✓
 \$ 010 0100✓
) 010 1000✓

(5)

- 2.3 2.3.1 1+0+0+1+ 0+1+0+1+ 0+1+1+1
 = 1 1 0 1✓ 1 1 1 1✓ 1 1 0 0✓

- 2.3.2 1001 0101 0111
 = 3✓ 5✓ 7✓

(2 × 3) (6)

- 2.4 A word is two or more bytes while word length is the number of bits in a word. (1)

- 2.5 An alphanumeric code is a binary code for a group of elements consisting of decimal digits, letters of the alphabet (both in uppercase and lowercase) and a certain number of special symbols,✓ e.g. ASCII.✓

(2)
[20]

QUESTION 3: LOGIC GATES, INTEGRATED CIRCUITS AND LOGIC FAMILIES

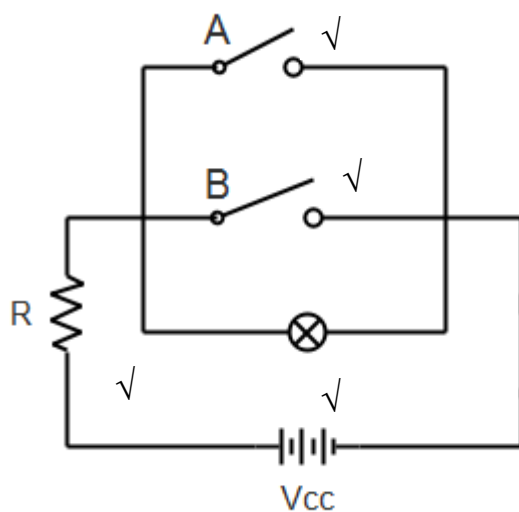
- 3.1 3.1.1 False
 3.1.2 False
 3.1.3 True
 3.1.4 True
 3.1.5 False

(5 × 1) (5)

- 3.2 3.2.1 NOR gate

(1)

3.2.2



(2)

3.2.3

A	B	Z
0	0	1
0	1	0
1	0	0
1	1	0

✓
✓
✓
✓

(2)

3.3

A	B	C	a	b	c	d	Z
0	0	0	1	1	0	0	0
0	0	1	1	1	1	0	1
0	1	0	1	0	0	1	1
0	1	1	1	0	0	0	0
1	0	0	0	1	0	0	0
1	0	1	0	1	0	0	0
1	1	0	0	0	0	0	0
1	1	1	0	0	0	0	0

✓

✓

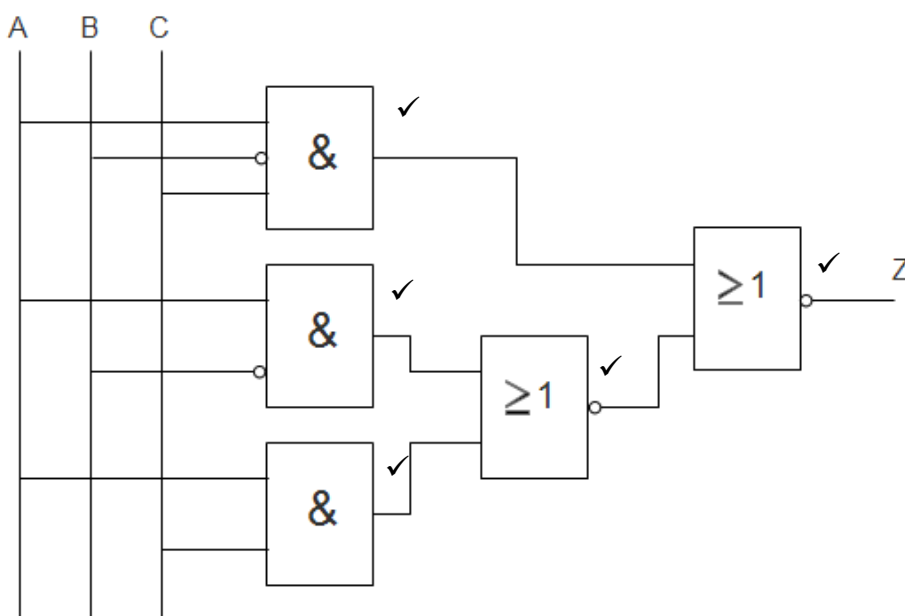
✓

✓

✓

(5)

3.4

(5)
[20]**QUESTION 4: MEMORY ELEMENTS AND MEMORIES**

- 4.1 4.1.1 D
 4.1.2 C
 4.1.3 A
 4.1.4 D
 4.1.5 B

(5 × 1) (5)

4.2 4.2.1

D	Q	$\bar{Q}$
0	0	1
1	1	0

✓

✓

(2)

- 4.2.2 It is called a delay flip-flop because it delays the flow of data ✓ by at least one clock pulse. ✓

(2)

- 4.2.3 The role of the NOT gate between the master and slave is to make sure that they do not switch ✓ at the same time. ✓

(2)

- 4.3 Universal serial bus

(2)

- 4.4
- CD
 - DVD
 - Magnetic tape
 - Punch cards
 - Magnetic drum
 - Paper tape
 - USB

(Any 3 × 1) (3)

- 4.5
- Low production cost
 - Reliability
 - Low power consumption
 - Greater/higher capacity
- (4)
[20]

QUESTION 5: SHIFT REGISTERS AND COUNTERS

- | | | | | |
|---------------|-------------------|--------|------------|-------------|
| 5.1 | 5.1.1 | C | | |
| | 5.1.2 | B | | |
| | 5.1.3 | C | | |
| | 5.1.4 | D | | |
| | 5.1.5 | C | | |
| | | | (5 × 1) | (5) |
| | | | | |
| 5.2 | 5.2.1 | True | | |
| | 5.2.2 | False | | |
| | 5.2.3 | True | | |
| | 5.2.4 | True | | |
| | 5.2.5 | False | | |
| | | | (5 × 1) | (5) |
| | | | | |
| 5.3 | • Johnson counter | | | |
| | • Ring counter | | | (2) |
| | | | | |
| 5.4 | 5.4.1 | 1010 | | |
| | | 1011 | | |
| | | 1110 | | |
| | | 1111 | | (4) |
| | | | | |
| | 5.4.2 | 4✓✓ | | (2) |
| | | | | |
| | 5.4.3 | 0011✓✓ | | (2) |
| | | | | [20] |
| | | | | |
| TOTAL: | | | 100 | |