



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

LOGIC SYSTEMS N4

14 August 2026

This marking guideline consists of 9 pages.

QUESTION 1

1.1 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ✓ (1)

1.2 16 ✓ (1)

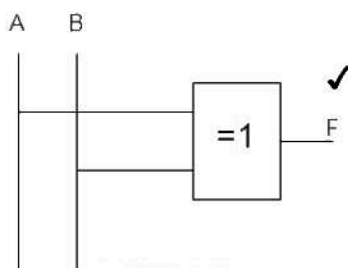
1.3
$$\begin{array}{r} 10110101_2 \\ 01001010 \\ \hline + 1 \\ \hline 01001011_2 \end{array}$$
 ✓ (2)

1.4 Asynchronous ✓ (1)

1.5 Fixed function ICs (integrated circuits) that have up to ten equivalent gate circuits (basic gates and flip-flops) on a single chip. ✓ ✓ (2)

1.6 $F = A \oplus B$ ✓

A	B	F
0	0	0
0	1	1
1	0	1
1	1	0



1.7 1.7.1 $A\bar{A} + \bar{A} = \bar{A}$ ✓
 1.7.2 $A + \bar{A} + \bar{B} = 1$ ✓
 1.7.3 $BCD + B = B(CD + 1) = B$ ✓
 1.7.4 $AB\bar{C} + ABC = AB$ ✓

(4 × 1) (4)

1.8 1.8.1

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

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

1.8.2

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

$$F = \bar{C}\bar{D} + \bar{A}\bar{B} + \bar{B}\bar{C} + AC \checkmark$$

1.8.3

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

$$F = \bar{A} \checkmark$$

(3 × 2) (6)
[20]

QUESTION 2

2.1	2.1.1	$34, 25_{10} = 100010, 01_2$
		$32, 1_8 = 011010, 001_2$

	1	0	0	0	1	0,	0	1	0	✓
	0	1	1	0	1	0,	0	0	1	✓
	1	0	0	1	0	1,	1	1	0	✓
								+	1	
	1	0	0	1	0	1,	1	1	1	✓
+	1	0	0	0	1	0,	0	1	0	
	0	0	1	0	0	0,	0	0	1	✓

$$= 8,125_{10} \checkmark$$

2.1.2 $16,25_{10} = 10000,01_2$
 $4,25_{10} = 100,01_2$

						1	0	0	0	0,	0	1	✓
								1	0	0,	0	1	✓
						<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	✓
+	1	0	0	0	0	0	0	1	0	0	0	0	✓
	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>1,</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	✓

$$= 45,1_{16} \checkmark$$

2.1.3 $AB, BA_{16} = 10101011, 10111010_2$
 $7, 1_8 = 111, 001_2$

$$\begin{array}{r}
 \begin{array}{cccccccccccccccc}
 & & & & & & 1 & 1 & 0 & 0 & 0 & 0, & 0 & 0 & 0 & 1 & \checkmark \\
 1 & 0 & | & 1 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1, & 1 & 1 & 0 & 1 & \checkmark \\
 \hline
 111001 & & & & & & & & & & & & & & & & \\
 - & 1 & 1 & 1 & 0 & 0 & 1 & & & & & & & & & & \\
 \hline
 & 1 & 1 & 1 & 0 & 0 & 1 & & & & & & & & & & \checkmark \\
 & 1 & 1 & 1 & 0 & 0 & 1 & & & & & & & & & & \\
 \hline
 & & & & & & & 1 & 0 & 1 & 1 & 1 & 0 & 1 & & & \checkmark \\
 & - & & & & & & & 1 & 1 & 1 & 0 & 0 & 1 & & & \\
 & & & & & & & & 1 & 0 & 0 & 1 & 0 & 0 & & & \checkmark
 \end{array}
 \end{array}$$

$$= 60,04_8 \checkmark$$

$$(3 \times 6) \quad (18)$$

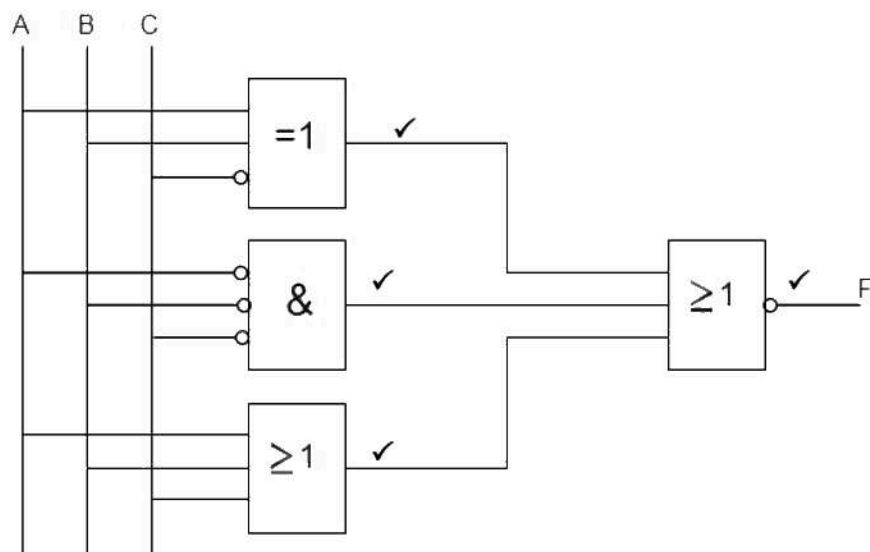
2.2 American Standard Code for Information Interchange ✓✓ (2)

2.3 * - 010 1010 ✓
 J - 100 1010 ✓
 (- 010 1000 ✓
 7 - 011 0111 ✓
 ? - 011 1111 ✓

(5)
 [25]

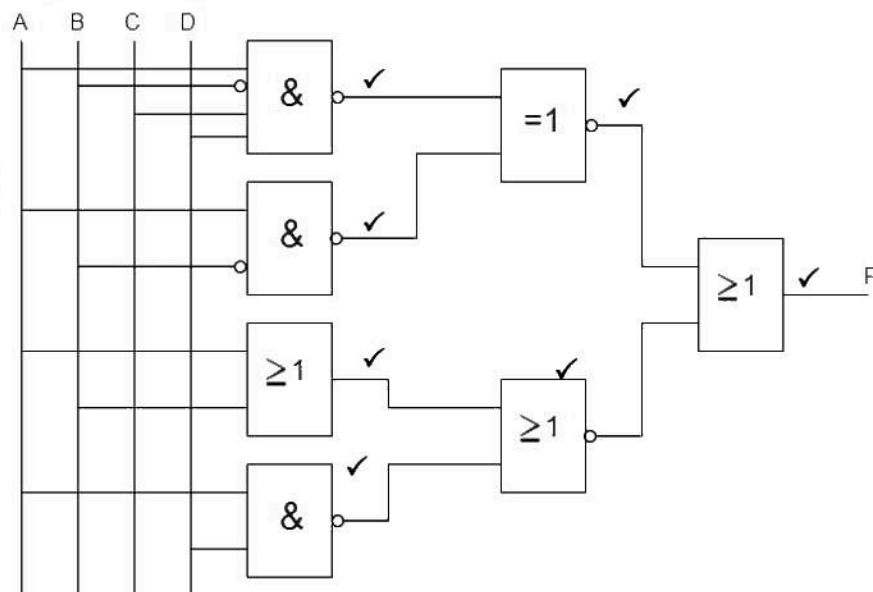
QUESTION 3

3.1 3.1.1



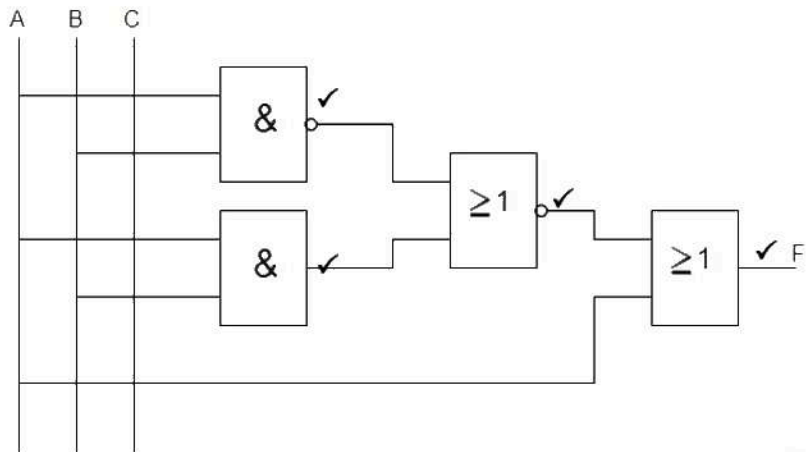
(4)

3.1.2



(7)

3.1.3



(4)

3.2

A	B	C	L
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

✓

✓

✓

✓

$$Z = \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC$$

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

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

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

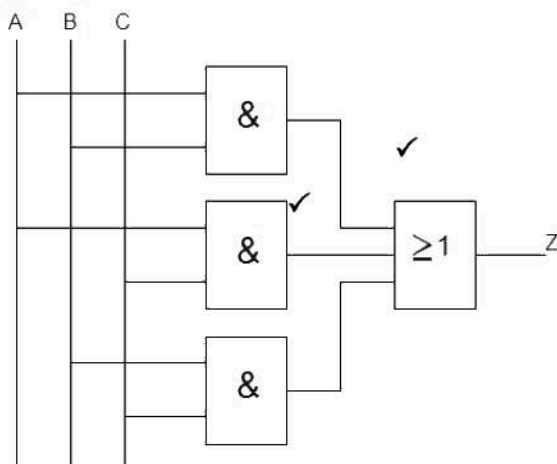
$$= B(A + C) + A\bar{B}C$$

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

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

$$= A(B + C) + BC$$

$$= AB + AC + BC$$



QUESTION 4

Input (8421)				Output (XS-3)			
A	B	C	D	W	X	Y	Z
0	0	0	0	0	0	1	1
0	0	0	1	0	1	0	0
0	0	1	0	0	1	0	1
0	0	1	1	0	1	1	0
0	1	0	0	0	1	1	1
0	1	0	1	1	0	0	0
0	1	1	0	1	0	0	1
0	1	1	1	1	0	1	0
1	0	0	0	1	0	1	1
1	0	0	1	1	1	0	0
1	0	1	0	∅	∅	∅	∅
1	0	1	1	∅	∅	∅	∅
1	1	0	0	∅	∅	∅	∅
1	1	0	1	∅	∅	∅	∅
1	1	1	0	∅	∅	∅	∅
1	1	1	1	∅	∅	∅	∅
✓ ^{1/2}	✓ ^{1/2}	✓ ^{1/2}	✓ ^{1/2}	✓ ^{1/2}	✓ ^{1/2}	✓ ^{1/2}	✓ ^{1/2}

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

✓

$$W = A + BD + BC \quad \checkmark$$

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

✓

$$X = B\bar{C}\bar{D} + \bar{B}D + \bar{B}C \quad \checkmark$$

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

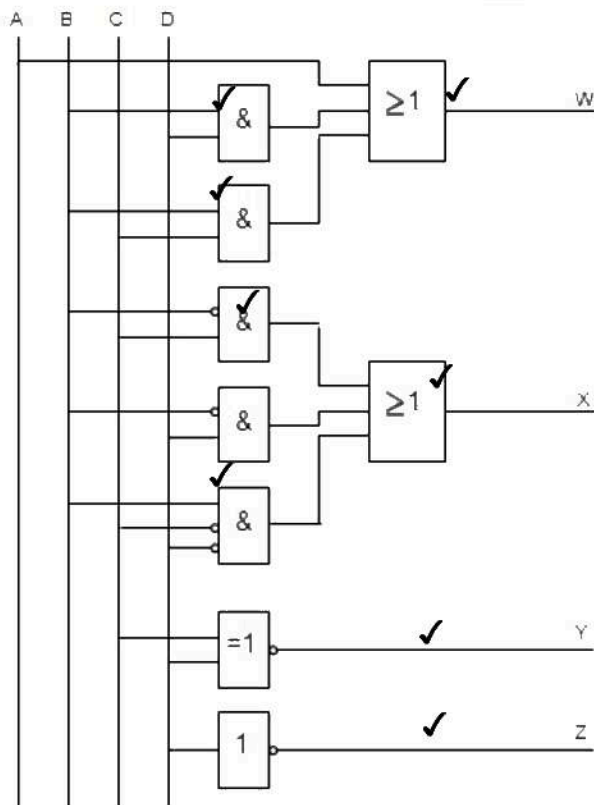
✓

$$Y = \bar{C}\bar{D} + CD = \overline{C \oplus D} \quad \checkmark$$

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

✓

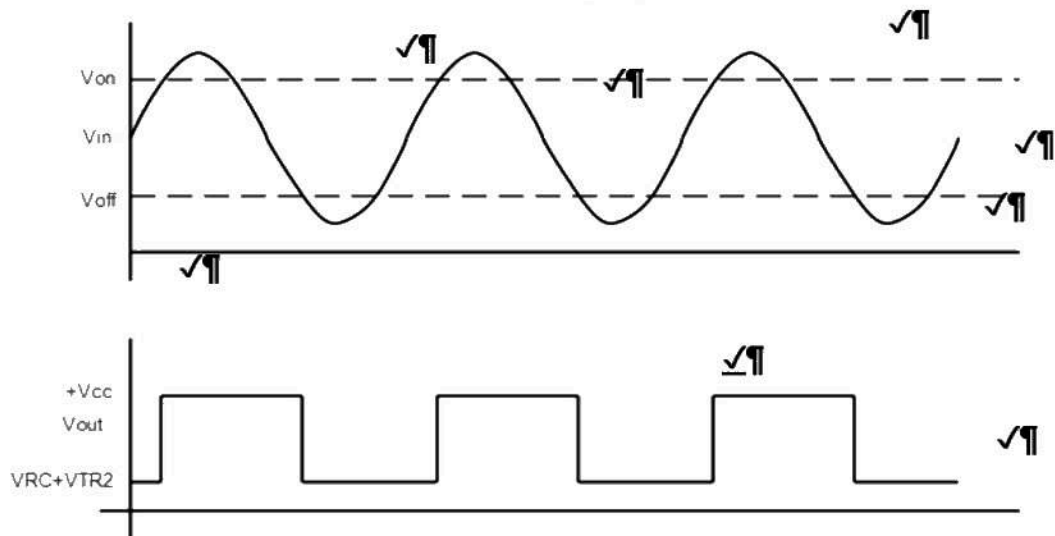
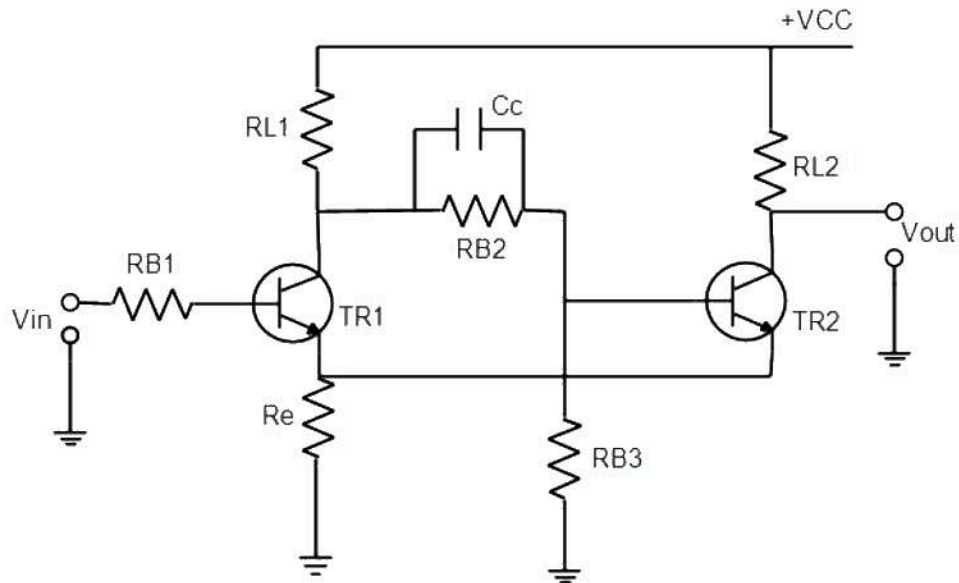
$$Z = \bar{D} \quad \checkmark$$



[20]

QUESTION 5

5.1



(8)

5.2

Hysteresis ensures that a Schmitt trigger produces a clean square wave by avoiding multiple unwanted transitions.✓ It stabilises the output by allowing only one change per threshold crossing, even if the sine wave input is noisy.✓

(2)
[10]

TOTAL: 100