



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

LOGIC SYSTEMS N4

12 April 2024

This marking guideline consists of 8 pages.

✓ = 1 MARK ✓½ = ½ MARK

QUESTION 1

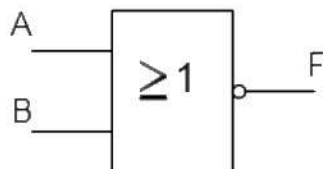
1.1 0; 1; 2; 3; 4; 5; 6; 7 (1)

1.2 F (1)

1.3 $F = \overline{A+B}$ ✓

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

✓



(3)

1.4 10110101_2
 01001010 ✓
 $\quad + 1$ ✓
 01001011_2 ✓ (2)

1.5 Logic 0 – 0V ✓
 Logic 1 – 5V ✓ (2)

1.6 1.6.1 1 ✓
 1.6.2 0 ✓
 1.6.3 AB ✓
 1.6.4 $\overline{A \oplus B} + A$ ✓
 1.6.5 $\overline{A} \overline{B} \overline{C}$ ✓

(5 × 1) (5)

1.7 1.7.1

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

✓

$F = 1$ ✓

1.7.2

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

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

1.7.3

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

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

(3 × 2) (6)
[20]

QUESTION 2

2.1 2.1.1 $13,25_{10} - E, C_{16}$

$$13,25_{10} = 1101,01_2 \quad \checkmark^{1/2}$$

$$E, C_{16} = 1110,11_2 \quad \checkmark^{1/2}$$

$$\begin{array}{r} 1101,01 \\ -1110,11 \quad \checkmark \\ \hline \end{array}$$

$$\begin{array}{r} 1101,01 \\ 0c + 0001,00 \quad \checkmark \\ \hline] \quad 1110,01 \quad \checkmark \\ = -0001,10 \quad \checkmark \end{array}$$

$$-0001,10_2 = -1,5_{16} \quad \checkmark$$

(6)

2.1.2 $38, B_{16} \times 3, 1_8$

$$38, B_{16} = 00111000, 1011_2 \quad \checkmark^{1/2}$$

$$3, 1_8 = 011, 001_2 \quad \checkmark^{1/2}$$

$$\begin{array}{r} 111000, 1011 \\ \times \quad 11, 0010 \\ \hline 11100010110 \quad \checkmark \\ 11100010110000 \quad \checkmark \\ + \quad 111000101100000 \quad \checkmark \\ \hline 10110001, 00100110 \quad \checkmark \end{array}$$

$$10110001, 00100110 = 261, 114_8 \quad \checkmark$$

(6)

2.1.3 $654, 3_8 \div 14, 5_{10}$

$$654, 3_8 = 110101100, 011_2 \quad \checkmark^{1/2}$$

$$14, 5_{10} = 1110, 1_2 \quad \checkmark^{1/2}$$

$$\begin{array}{r} 11101, 10001 \quad \checkmark \\ 11101 \overline{) 1101011000, 11000} \\ \underline{-11101} \quad \checkmark \\ 110001 \\ \underline{-11101} \quad \checkmark \\ 101000 \\ \underline{-11101} \\ 101100 \\ \underline{-11101} \\ 111111 \\ \underline{-11101} \quad \checkmark \\ 101000 \\ \underline{-11101} \end{array}$$

$$11101, 10001 = 1D, 88_{16} \quad \checkmark$$

(6)

2.2 American Standard Code for Information Interchange

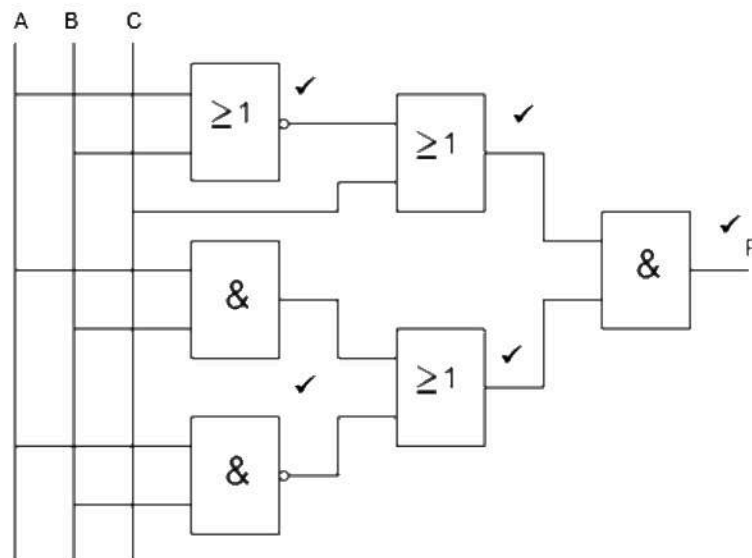
(2)

2.3 S - 101 0011 ✓
 @ - 100 0000 ✓
 t - 111 0100 ✓
 ! - 010 0001 ✓
 4 - 011 0100 ✓

(5)
 [25]

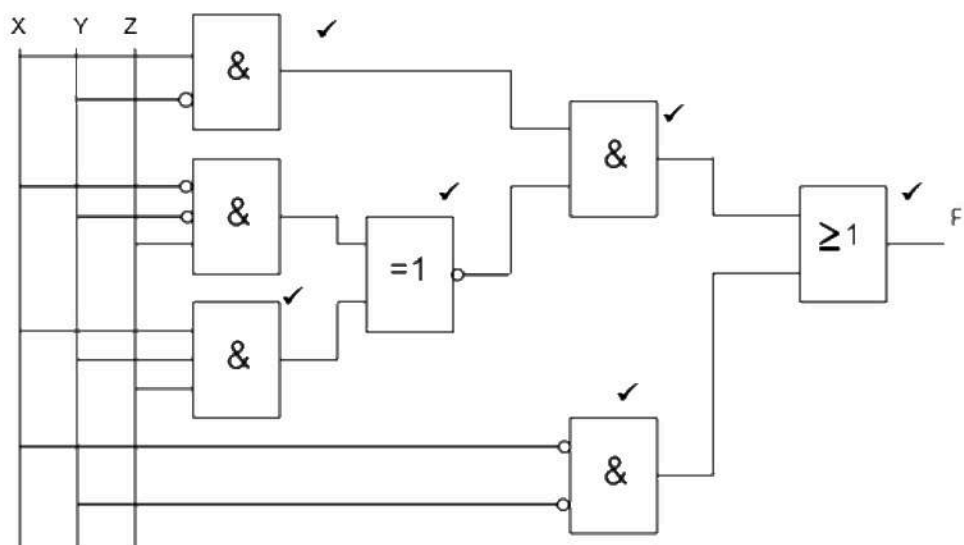
QUESTION 3

3.1 3.1.1



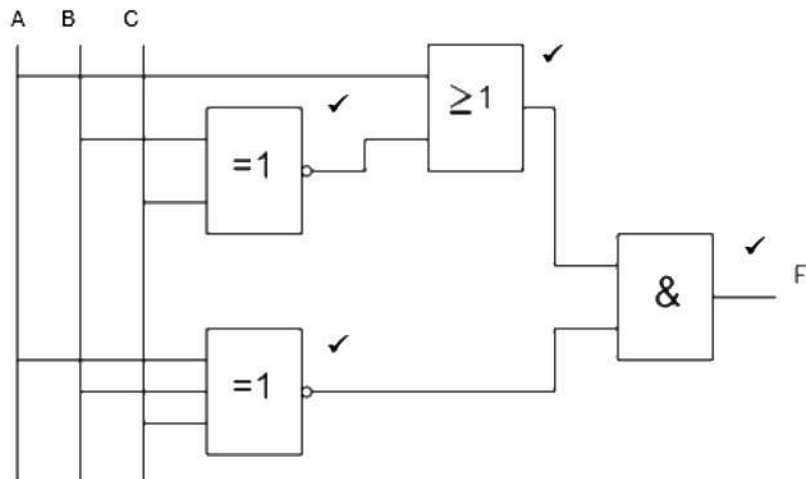
(5)

3.1.2



(6)

3.1.3

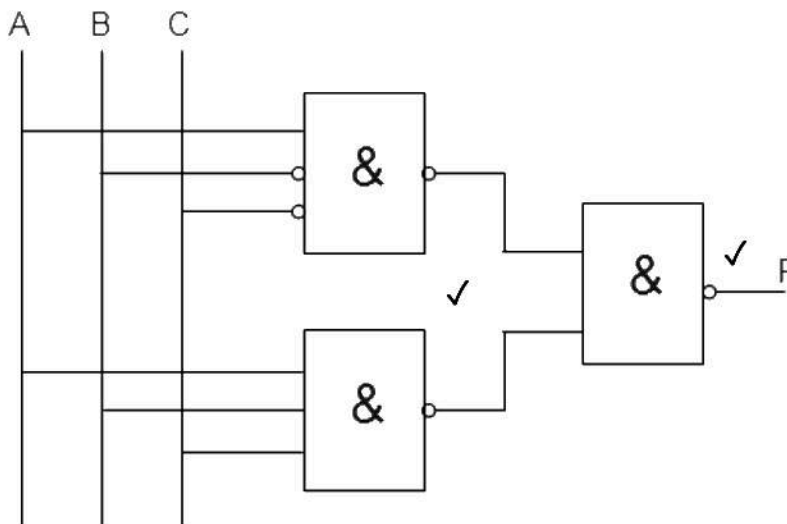


(4)

3.2

$$\begin{aligned}
 F &= A(\bar{A} + \bar{B} + C)(A + \bar{B} + C)(\bar{A} + B + \bar{C}) \\
 &= (A\bar{A} + AC)(A + \bar{B} + C)(\bar{A} + B + \bar{C}) \checkmark^{1/2} \\
 &= (A\bar{B} + A\bar{B} + A\bar{B}C + AC + A\bar{B}C + AC)(\bar{A} + B + \bar{C}) \checkmark^{1/2} \\
 &= (A\bar{B} + A\bar{B}C + AC)(\bar{A} + B + \bar{C}) \checkmark^{1/2} \\
 &= (A\bar{B} + AC)(\bar{A} + B + \bar{C}) \checkmark^{1/2} \\
 &= A\bar{B}\bar{C} + ABC \checkmark^{1/2}
 \end{aligned}$$

$$\begin{aligned}
 F &= \overline{\overline{A\bar{B}\bar{C}} + \overline{ABC}} \\
 &= \overline{\overline{A\bar{B}\bar{C}} \cdot \overline{ABC}} \checkmark^{1/2}
 \end{aligned}$$



(5)

3.3

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

LHS:

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

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

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

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

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

$$\text{let } A \oplus B = x$$

$$C\bar{x} + \bar{C}x \quad \checkmark$$

$$= C + x$$

$$= A \oplus B \oplus C \quad \checkmark$$

$$= \text{RHS}$$

(5)
[25]

QUESTION 4

Inputs (8421 BCD)				Outputs (Gray)			
A	B	C	D	W	X	Y	Z
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1
1	0	1	0	1	1	1	1
1	0	1	1	1	1	1	0
1	1	0	0	1	0	1	0
1	1	0	1	1	0	1	1
1	1	1	0	1	0	0	1
1	1	1	1	1	0	0	0
				✓	✓	✓	✓

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

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

$$X = \bar{A}B + A\bar{B} \quad \checkmark = A \oplus B \quad \checkmark$$

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

CD

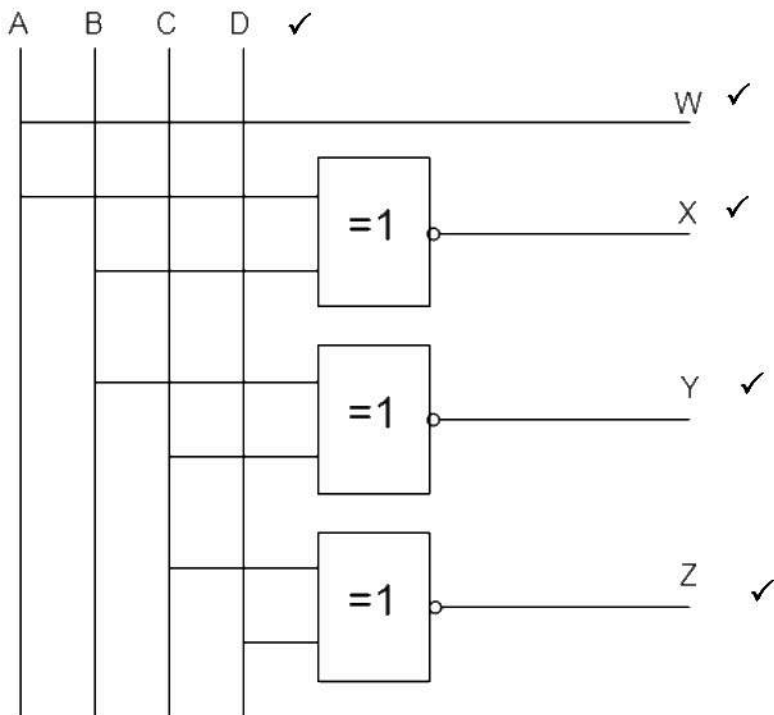
AB \ CD	00	01	11	10
00				
01	1	1	1	1
11				
10	1	1	1	1

$$Y = B\bar{C} + \bar{B}C \checkmark$$

$$= B \oplus C \checkmark$$

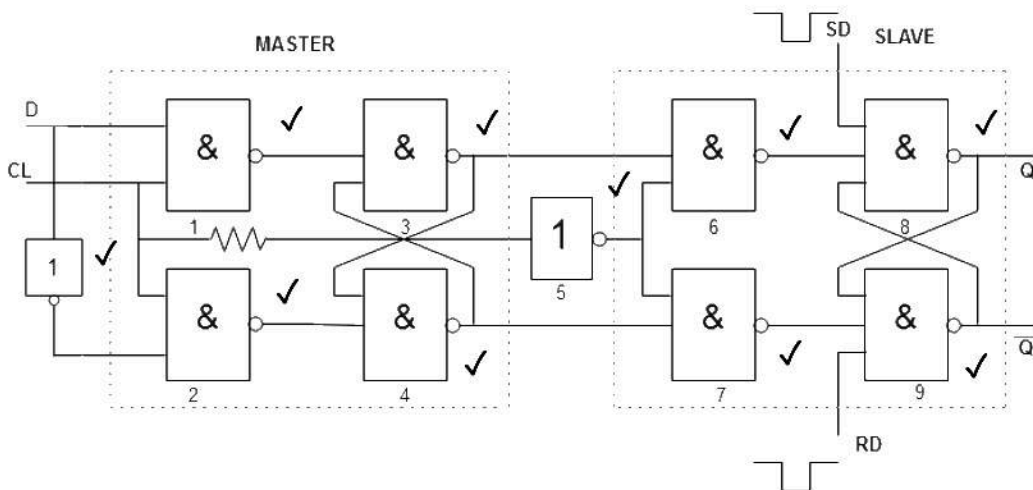
$$Z = \bar{C}D + C\bar{D} \checkmark$$

$$= C \oplus D \checkmark$$



[20]

QUESTION 5



[10]

TOTAL: