



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

LOGIC SYSTEMS N4

5 December 2024

This marking guideline consists of 11 pages.

QUESTION 1

1.1 8 (1)

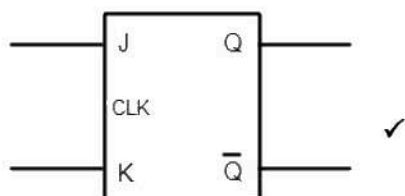
1.2 $0,125_{10}$ ✓ (1)

1.3 Logic 0 – 0V
Logic 1 – 5V (2)

1.4

J	K	Q	$\bar{Q}$
0	0	No change	
0	1	0	1
1	0	1	0
1	1	Toggle	

✓ ✓



(3)

1.5 4 (1)

1.6 1.6.1 1 ✓

1.6.2 $B + A$ ✓

1.6.3 1 ✓

1.6.4 $A \oplus B$ ✓

(4 × 1) (4)

1.7 8 (1)

1.8 When one or more of the inputs are at a logic 1. (1)

1.9 1.9.1

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

✓

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

1.9.2

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

✓

$$Z = B\bar{C} + ACD + \bar{B}C \checkmark$$

1.9.3

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

✓

$$Z = 1 \checkmark$$

(3 × 2)

(6)
[20]

QUESTION 2

2.1 2.1.1

$$9,25_{10} - B, C_{16}$$

$$9,25_{10} = 1001,01_2 \checkmark^{1/2}$$

$$B, C_{16} = 1011,11_2 \checkmark^{1/2}$$

$$\begin{array}{r} 0 * 01001,01 \checkmark \\ + 1 * 10100,00 \checkmark \\ \hline 1 * 11101,01 \checkmark \end{array}$$

$$= -00010,10 \checkmark$$

$$-10,10_2 = -2,4_8 \checkmark$$

2.1.2

$$14,75_{10} \times 5,2_8$$

$$14,75_{10} = 1110,11_2 \checkmark^{1/2}$$

$$5,2_8 = 101,010_2 \checkmark^{1/2}$$

$$\begin{array}{r} 1110,11 \\ \times 101,01 \\ \hline 111011 \checkmark \\ 11101100 \\ + 1110110000 \checkmark \\ \hline 10011010111 \checkmark \end{array}$$

$$10011010111 = 4D,7_{16} \checkmark$$

2.1.3 $66B,6_{16} \div 46,1_8$

$66B,6_{16} = 011001101011,0110_2 \checkmark \frac{1}{2}$

$46,1_8 = 100110,0001_2 \checkmark \frac{1}{2}$

$$\begin{array}{r}
 101011,0 \checkmark \\
 1001100001 \overline{) 110011010110110} \\
 \underline{-1001100001} \checkmark \\
 110100111 \\
 \underline{-100110001} \checkmark \\
 111011001 \\
 \underline{-100110001} \\
 101010001 \\
 \underline{-100110001} \\
 100000 \checkmark \\
 101011 = 53_8 \checkmark
 \end{array}$$

(3 × 6) (18)

2.2

	P ₁	P ₂	D ₁	P ₃	D ₂	D ₃	D ₄	
Position	1	2	3	4	5	6	7	
Binary Values	0001	0010	0011	0100	0101	0110	0111	
Word	1	0	0	1	1	0	1	
Parity 1	1		0		1		1	1 ✓
Parity 2		0	0			0	1	1 ✓
Parity 3				1	1	0	1	1 ✓

Position 7 ✓

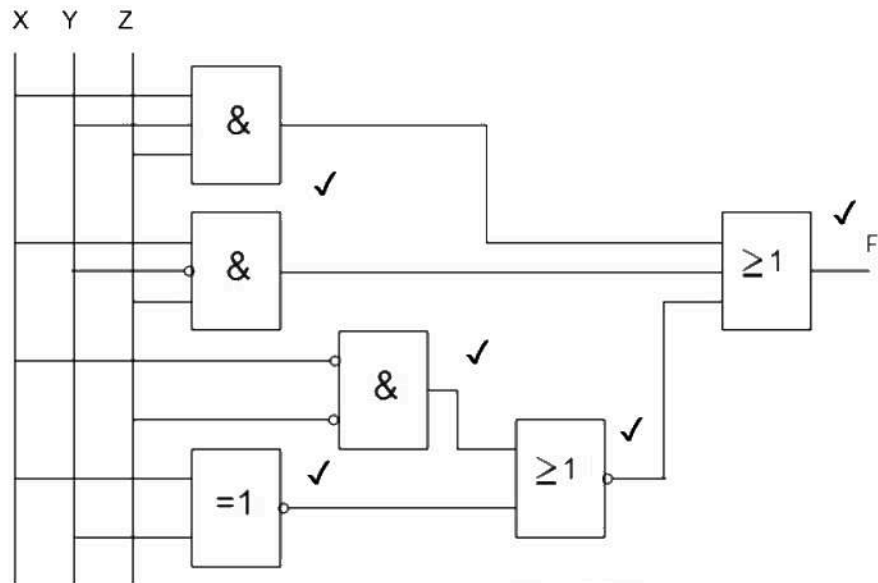
New word : 1001100 ✓✓

(7)
[25]

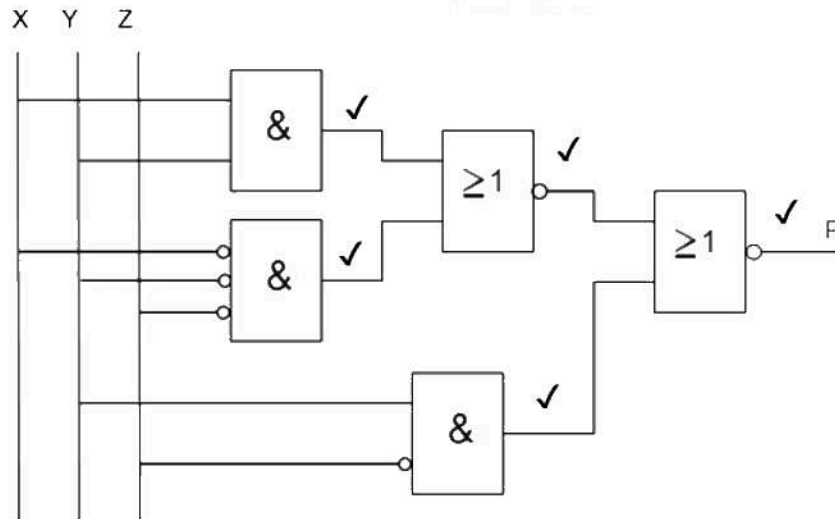
QUESTION 3

3.1

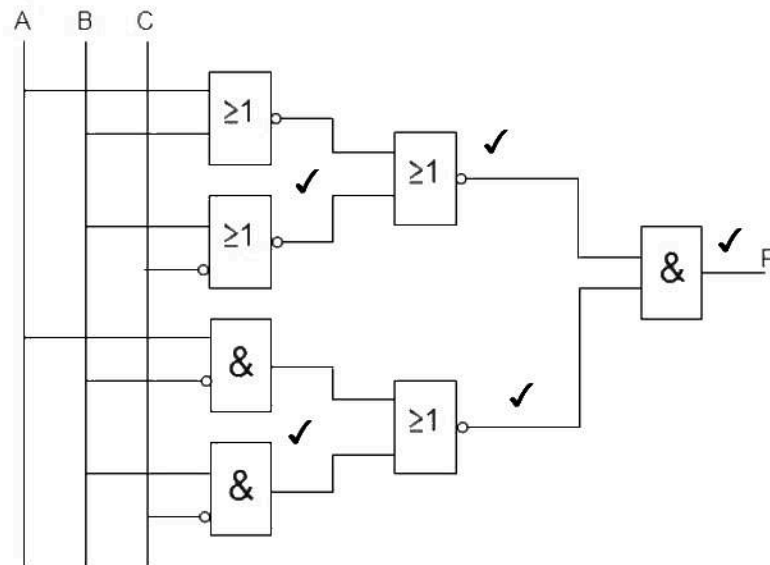
3.1.1



3.1.2



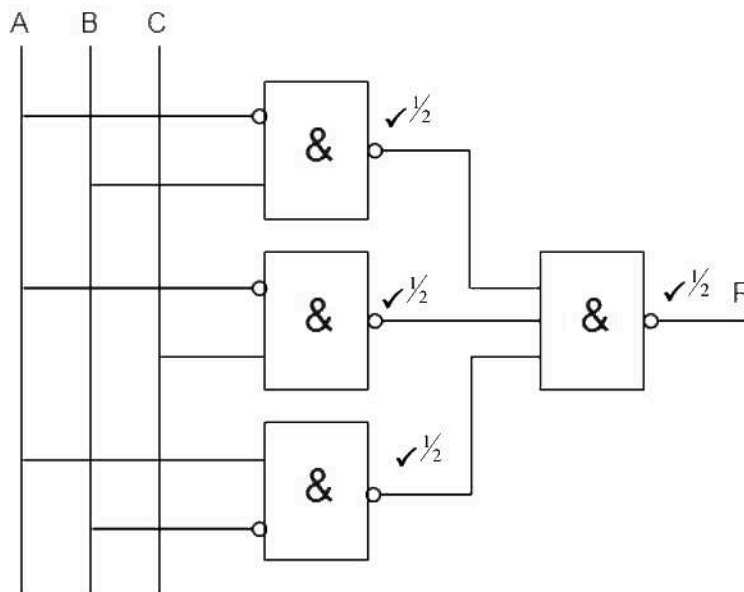
3.1.3



(5 × 3) (15)

3.2

$$\begin{aligned}
 F &= (A+B) [\bar{A}(\bar{B}+\bar{C})] + \bar{A}C + A\bar{B} \\
 &= (A+B)(\bar{A}\bar{B} + \bar{A}\bar{C}) + \bar{A}C + A\bar{B} \quad \checkmark \frac{1}{2} \\
 &= 0 + 0 + 0 + \bar{A}\bar{B}\bar{C} + \bar{A}C + A\bar{B} \quad \checkmark \frac{1}{2} \\
 &= \bar{A}(\bar{B}\bar{C} + C) + A\bar{B} \quad \checkmark \frac{1}{2} \\
 &= \bar{A}(B+C) + A\bar{B} \\
 &= \bar{A}B + \bar{A}C + A\bar{B} \quad \checkmark \frac{1}{2} \\
 &= \overline{\bar{A}B + \bar{A}C + A\bar{B}} \quad \checkmark \frac{1}{2} \\
 &= \overline{\bar{A}B} \cdot \overline{\bar{A}C} \cdot \overline{A\bar{B}} \quad \checkmark \frac{1}{2}
 \end{aligned}$$



(5)

3.3 $F = A(\bar{A} + \bar{B} + \bar{C})(B + C)(A + B + C)$

$$= (A\bar{B} + A\bar{C})(B + C)(A + B + C) \checkmark \frac{1}{2}$$

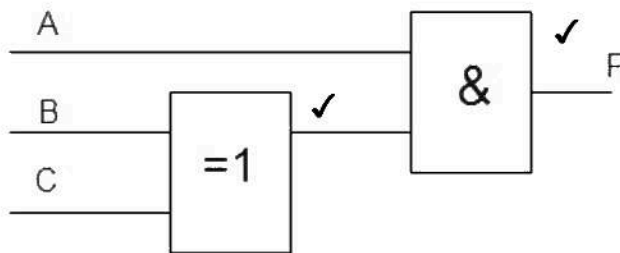
$$= (A\bar{B}C + AB\bar{C})(A + B + C) \checkmark \frac{1}{2}$$

$$= A\bar{B}C + A\bar{B}\bar{C} + AB\bar{C} + ABC \checkmark \frac{1}{2}$$

$$= A\bar{B}C + AB\bar{C} \checkmark \frac{1}{2}$$

$$= A(\bar{B}C + B\bar{C}) \checkmark \frac{1}{2}$$

$$= A(B \oplus C) \checkmark \frac{1}{2}$$



(5)
[25]

QUESTION 4

Input (Gray code)				Output (Binary)			
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	1
0	1	0	1	0	1	1	0
0	1	1	0	0	1	0	0
0	1	1	1	0	1	0	1
1	0	0	0	1	1	1	1
1	0	0	1	1	1	1	0
1	0	1	0	1	1	0	0
1	0	1	1	1	1	0	1
1	1	0	0	1	0	0	0
1	1	0	1	1	0	0	1
1	1	1	0	1	0	1	1
1	1	1	1	1	0	1	0
✓	✓	✓	✓	✓	✓	✓	✓

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

✓

$$W = A \quad \checkmark$$

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

✓

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

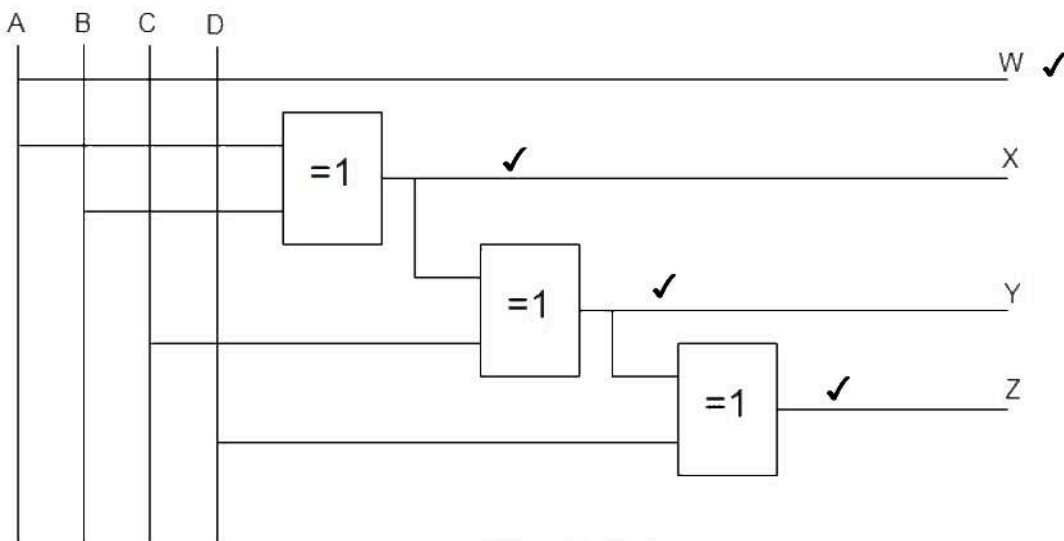
CD \ AB	00	01	11	10
00		1		1
01		1		1
11	1		1	
10	1		1	

✓

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

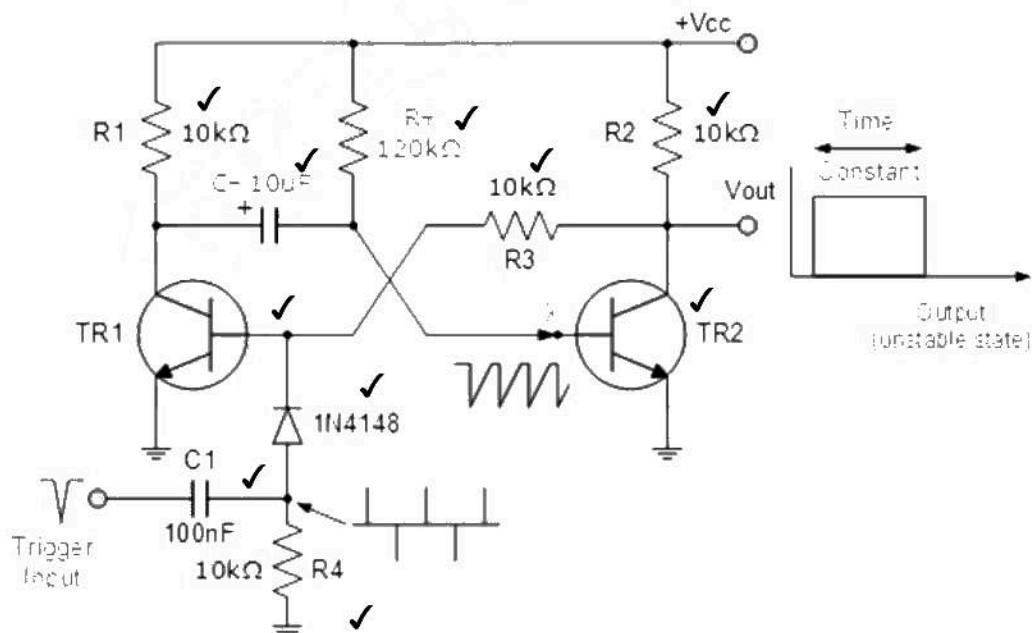
AB \ CD	00	01	11	10
00		1		1
01	1		1	
11		1		1
10	1		1	

$$Z = A \oplus B \oplus C \oplus D$$



[20]

QUESTION 5



Accept other variations of the circuit

[10]

TOTAL: