



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

LOGIC SYSTEMS N3

11 April 2024

This marking guideline consists of 8 pages.

QUESTION 1: NUMBER SYSTEMS

1.1

	16	8	4	2	1	0.5	0.25	0.125	
16,25 ₁₀	1	0	0	0	0	,0	1	0 ₂	✓
10,125 ₁₀		1	0	1	0	,0	0	1 ₂	✓

$$\begin{array}{rcccccccc} & 1 & 0 & 0 & 0 & 1 & ,0 & 1 & 0 \\ + & & 1 & 0 & 1 & 0 & ,0 & 0 & 1 \\ \hline = & 1 & 1 & 0 & 1 & 0 & ,0 & 0 & 1_2 \quad \checkmark \end{array}$$

$$\begin{aligned} 11010,011_2 &= 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^1 + 1 \times 2^{-2} + 1 \times 2^{-3} \checkmark \\ &= 16 + 8 + 2 + 0,25 + 0,125 \\ &= 26,375_{10} \checkmark \end{aligned}$$

(5)

1.2

	16	8	4	2	1	0.5	0.25	0.125	
22,25 ₁₀	1	0	1	1	0	,0	1	0 ₂	✓
8,625 ₁₀		1	0	0	0	,1	0	1 ₂	✓

$$\begin{array}{rcccccccc} & 1 & 0 & 1 & 1 & 0 & ,0 & 1 & 0 \\ - & & 1 & 0 & 0 & 0 & ,1 & 0 & 1 \\ \hline = & & 1 & 1 & 0 & 0 & ,1 & 0 & 1_2 \quad \checkmark \end{array}$$

Binary	1	1	0	1	1	0	1	0	
Dec			13				10		✓
Hex				D	A				✓

(5)

1.3

	32	16	8	4	2	1	0.5	0.25	
10,25 ₁₀			1	0	1	0	,0	1 ₂	✓
7,5 ₁₀				1	1	1	,1	0 ₂	✓

X						1	0	1	0	,0	1
							1	1	1	.1	0
						0	0	0	0	0	0
+					1	0	1	0	0	1	0
+				1	0	1	0	0	1	0	0
+			1	0	1	0	0	1	0	0	0
		1	0	1	0	0	1	0	0	0	0
=	1	0	0	1	1	0	0,	1	1	1	0 ₂ ✓

$$\begin{aligned} 1001100,111_2 &= 1 \times 2^6 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^{-1} + 1 \times 2^{-2} + 1 \times 2^{-3} \checkmark \\ &= 64 + 8 + 4 + 0,5 + 0,25 + 0,125 \\ &= 76,875_{10} \checkmark \end{aligned}$$

(5)

2.3	POSITIONS	1	2	3	4	5	6	7
	NUMBERS	P ₁	P ₂	D ₁	P ₃	D ₂	D ₃	D ₄
		P ₁	P ₂	1	P ₃	0	0	1

$$\begin{aligned}
 P_1 &= P_1 + P_3 + P_5 + P_7 \\
 &= ? + 1 + 0 + 1 \\
 &= 0 \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 P_2 &= P_2 + P_3 + P_6 + P_7 \\
 &= ? + 1 + 0 + 1 \\
 &= 0 \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 P_3 &= P_4 + P_5 + P_6 + P_7 \\
 &= ? + 0 + 0 + 1 \\
 &= 1 \quad \checkmark
 \end{aligned}$$

POSITIONS	1	2	3	4	5	6	7
NUMBERS	P ₁	P ₂	D ₁	P ₃	D ₂	D ₃	D ₄
Data to be transmitted is:	0	0	1	1	0	0	1

✓ (4)

2.4	O	-	1101 0110	✓
	u	-	1010 0100	✓
	t	-	1010 0011	✓
	c	-	1000 0011	✓
	o	-	1001 0110	✓
	m	-	1001 0100	✓
	e	-	1000 0101	✓
	s	-	1010 0010	✓

(8)
[20]

QUESTION 3: LOGIC GATES, ARITHMETIC ELEMENTS, ENCODERS AND DECODERS

3.1	3.1.1	True
	3.1.2	False
	3.1.3	True
	3.1.4	False

(4 × 1) (4)

3.2	3.2.1	Circuit 1 is an AND gate Circuit 2 is an Inverter or NOT gate
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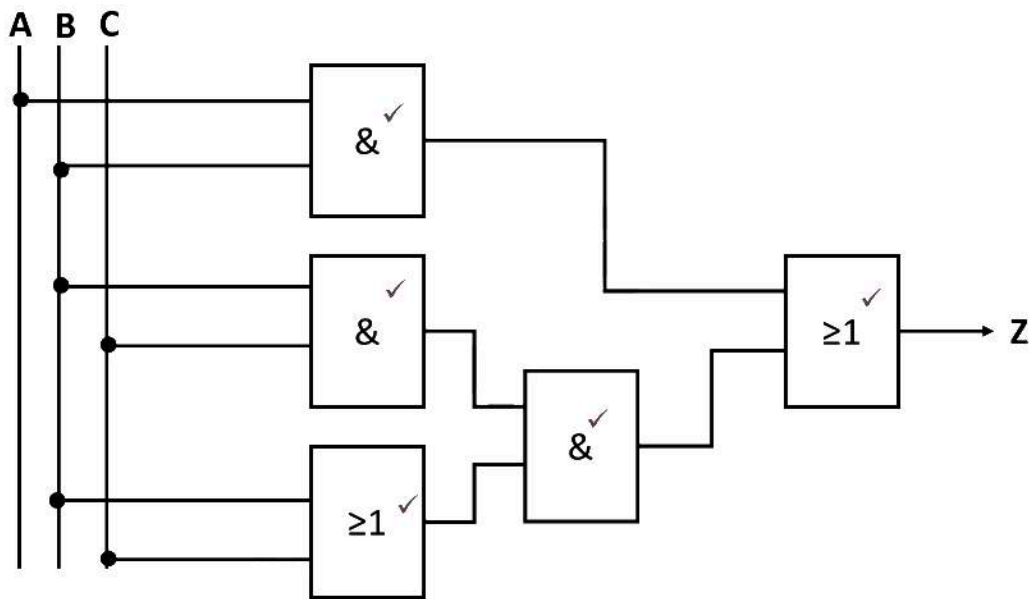
(2)

3.2.2

A	B	Z
0	0	1 ✓
0	1	1 ✓
1	0	1 ✓
1	1	0 ✓

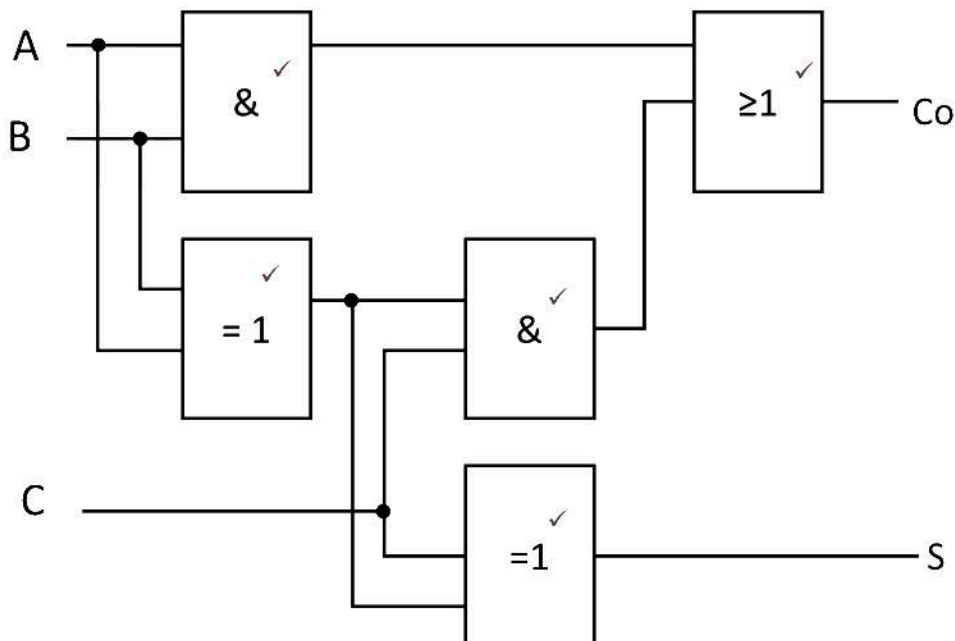
(4)

3.3



(5)

3.4



(5)
[20]

QUESTION 4: MEMORY ELEMENTS, MEMORIES AND INTEGRATED CIRCUITS

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

(5 × 1) (5)

- 4.2 4.2.1 Volatile memory is a memory that loses data when the power is lost. ✓
 Examples: RAM, Cache ✓

(Any correct example = 1 mark)

- 4.2.2 None-volatile memory is a memory that retains data even when the power is lost. ✓
 Examples: Hard drives, ROM, Flash drives, CD-R, DVD-R ✓

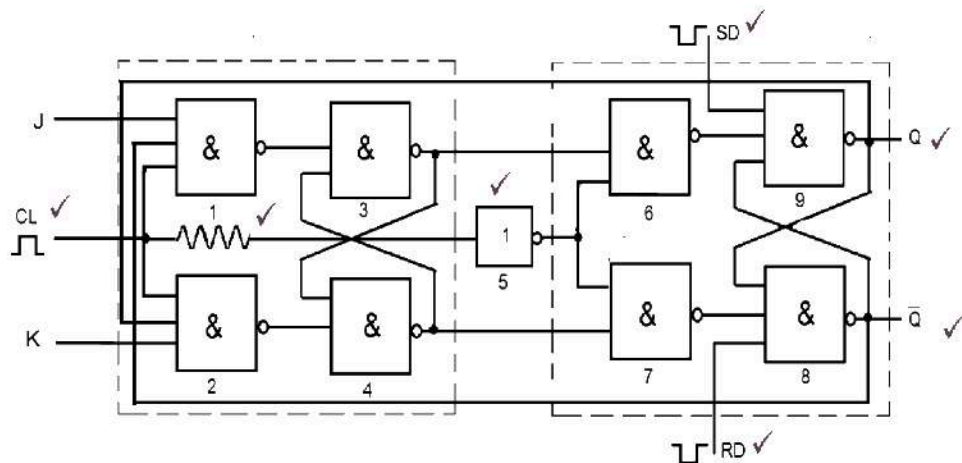
(Any correct example = 1 mark)

(2 × 2) (4)

- 4.3 • Dynamic RAM consists of one or more transistors and a capacitive element on which the data bit is stored as a charge. ✓✓
 • Static RAM consists of flip-flop without a capacitive element which makes it more simple. ✓✓

(2 × 2) (4)

4.4



(7)
 [20]

QUESTION 5: SHIFT REGISTERS AND COUNTERS

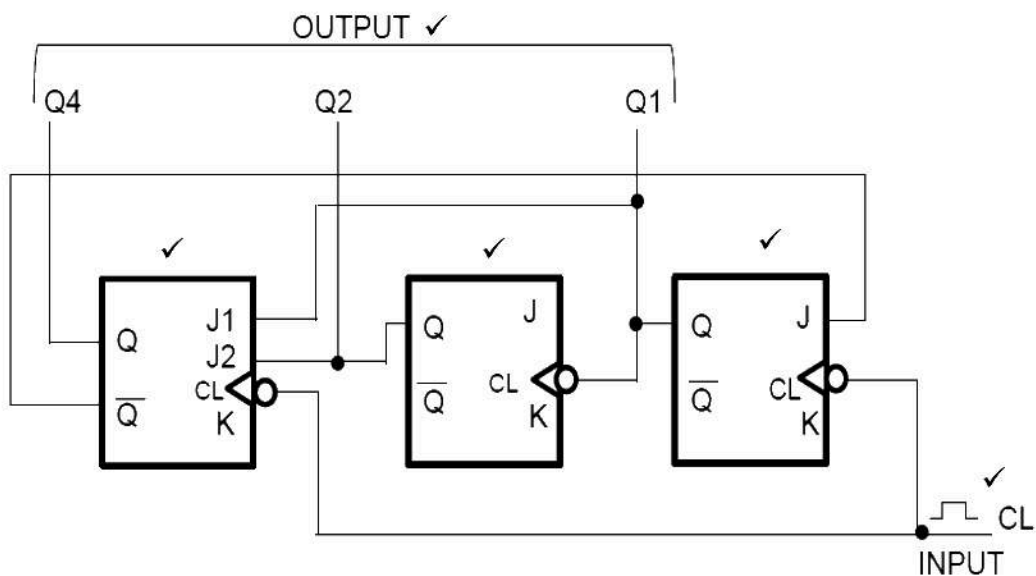
- 5.1
- A synchronous counter is a type of a digital counter where all flip-flops are clocked with one clock pulse simultaneously.
 - A ripple counter, also known as an asynchronous counter, is a type of a digital counter where the output of one flip-flop is used to clock the following flip-flop.
- (2 × 1) (2)

5.2

Q ₁₆	Q ₈	Q ₄	Q ₂	Q ₁	Clock pulse	
1	0	1	1	0	0	
0	1	1	0	0	1	✓
1	1	0	0	0	2	✓
1	0	0	0	0	3	✓
0	0	0	0	1	4	✓
0	0	0	1	0	5	✓
0	0	1	0	0	6	✓
0	1	0	0	0	7	✓
1	0	0	0	0	8	✓
0	0	0	0	1	9	✓

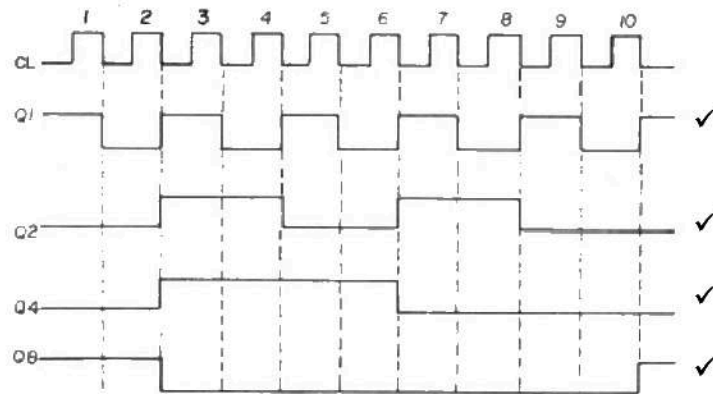
(9)

5.3



(5)

5.4



(4)
[20]

TOTAL: 100