



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N4

2 AUGUST 2018

This marking guideline consists of 7 pages.

QUESTION 1

- 1.1 Converts decimal to the binary equivalent. (2)
- 1.2 A decoder converts binary to decimal and an encoder converts decimal to the required code. (2)
- 1.3 1.3.1 An input that forces the Q output of a memory element to '1'
- 1.3.2 An input that forces the Q output of a memory element to '0' (2 × 2) (4)
- 1.4 Sum of the weights equals a single digit 9 (2)
- 1.5 1.5.1 X
- 1.5.2 $\bar{X} + Y$
- 1.5.3 1
- 1.5.4 X
- 1.5.5 $\bar{X}$ (2 × 1) (2)
- [15]**

QUESTION 2

- 2.1 2.1.1 $17,5_8 = 01111,101_2$ ✓
 $25,75_{10} = 11001,110_2$ ✓
 $= 11001,110$ 2nd complement = $00110,001$
 $\begin{array}{r} +1 \\ \hline 00110,010 \end{array}$ ✓
- $\begin{array}{r} 01111,101 \\ + 00110,010 \\ \hline 10101,111 \end{array}$ ✓✓
No Carry
- $\begin{array}{r} 01010,000 \\ +1 \\ \hline -1010,001 \end{array}$
- Therefore $1111,101_2 - 11001,110_2 = -10,125_{10}$ ✓

2.1.2 $A5, C_{16} = 10100101,1100_2 \checkmark$
 $3,5_8 = 011,101_2 \checkmark$

$$\begin{array}{r}
 101001011100 \\
 11101 \checkmark \\
 \hline
 101001011100 \\
 000000000000 \\
 101001011100 \\
 101001011100 \\
 101001011100 \\
 \hline
 1001011000,1101100_2 \checkmark \checkmark
 \end{array}$$

Therefore $10100101,1100_2 \times 11,101_2 = 1130,660_8 \checkmark$

(2 × 6) (12)

2.3 $75,125_{10} = 1001011,001_2 \checkmark$
 $25,1_8 = 010101,001_2 \checkmark$

$$\begin{array}{r}
 11,100 \\
 10101001 \sqrt{1001011001000} \\
 -10101001 \\
 \hline
 10000111 \\
 -10101001 \\
 \hline
 10111100 \\
 -10101001 \\
 \hline
 0001001100 \checkmark \checkmark \checkmark
 \end{array}$$

Therefore $1001011,001_2 \div 10101,001_2 = 11,100_2 = 3,5_{10} \checkmark$

(6)

2.4 $58,25_{10} = 0111010,0100_2$ 2's complement $1000101,1011 \checkmark$

$$\begin{array}{r}
 +1 \\
 \hline
 1000101,1100
 \end{array}$$

$-9,0625_{10} = 0001001,0001_2$ 2's complement $1110110,1110 \checkmark$

$$\begin{array}{r}
 +1 \\
 \hline
 1110110,1111
 \end{array}$$

Carry1

$$\begin{array}{r}
 1000101,1100 \\
 1110110,1111 \\
 0111100,1011 \\
 \hline
 1000011,0100 \\
 +1 \\
 \hline
 -1000011,0101 \checkmark \checkmark \checkmark
 \end{array}$$

Therefore $-58,25_{10} - 9,0625_{10} = -1000011,0101 = -67,3125_{10} \checkmark$

(6)
[24]

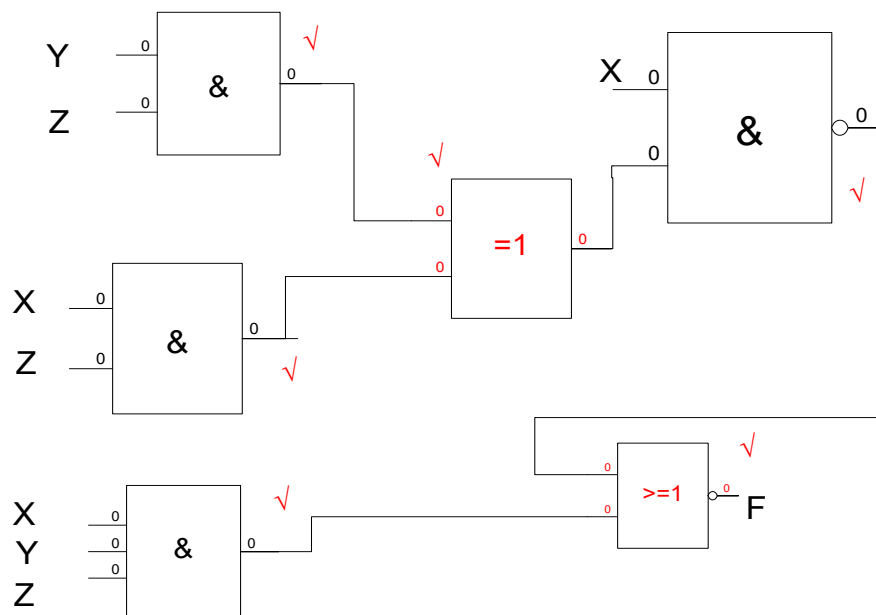
QUESTION 3

3.1 3.1.1 $F = \overline{A}C + \overline{B}C + \overline{A}\overline{C} + \overline{A}\overline{B} + \overline{B}\overline{C} + ABC$
 $= \overline{A}C + \overline{B}C + \overline{A}\overline{B} + \overline{A}\overline{C} + \overline{A}\overline{B} + B(\overline{C} + AC)✓$
 $= \overline{A}C + \overline{B}C + \overline{A}\overline{B} + \overline{A}\overline{C} + \overline{B}\overline{C} + B(A + \overline{A})✓$
 $= \overline{A}C + \overline{B}C + \overline{A}\overline{B} + \overline{A}\overline{C} + B(1 + \overline{C})✓$
 $= \overline{A}C + \overline{B}C + B + A(1 + \overline{C})✓$
 $= A + B + C + \overline{B}C✓$
 $= A + B + C✓$

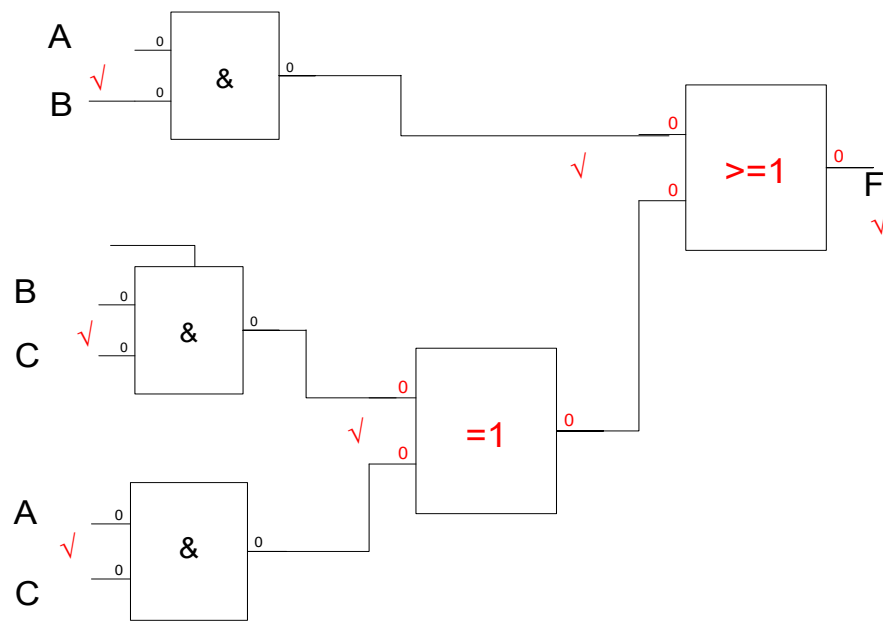
3.1.2 $F = A\overline{B}\overline{C} + \overline{A}BC + ABC + \overline{A}\overline{B}C$
 $= A(\overline{B}\overline{C} + BC) + \overline{A}(\overline{B}C + B\overline{C})✓$
 $= A(\overline{B} \oplus C) + \overline{A}(B \oplus C)✓$
 LET $B \oplus C = K✓$
 $= A\overline{K} + \overline{A}K✓$
 $= A \oplus K✓$
 $= A \oplus B \oplus C✓$

(2 × 6) (12)

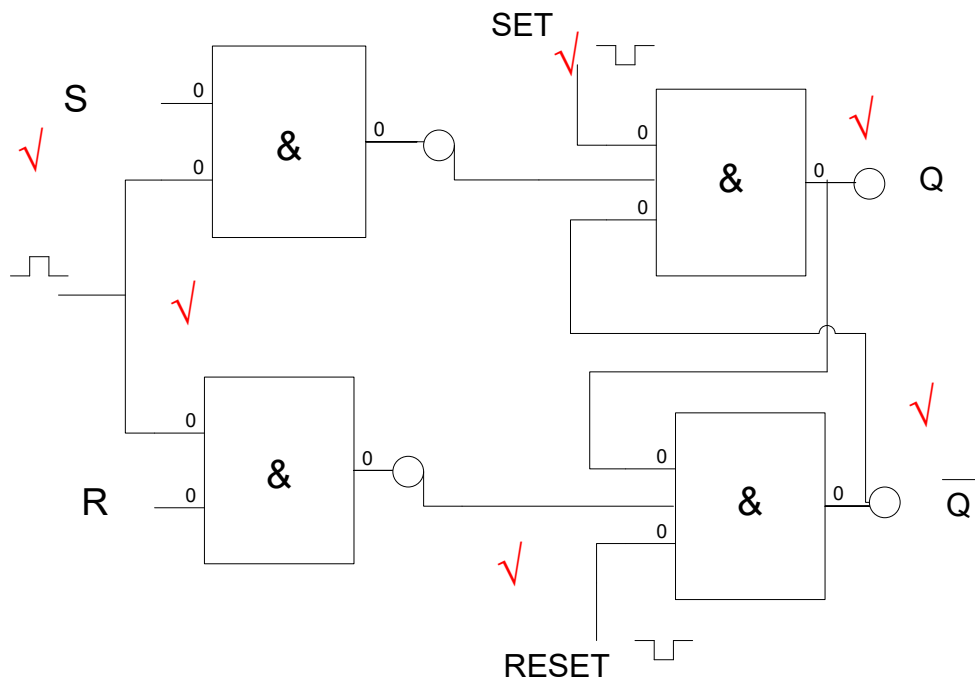
3.2 3.2.1



3.2.2

(2 × 6) (12)
[24]**QUESTION 4**

4.1

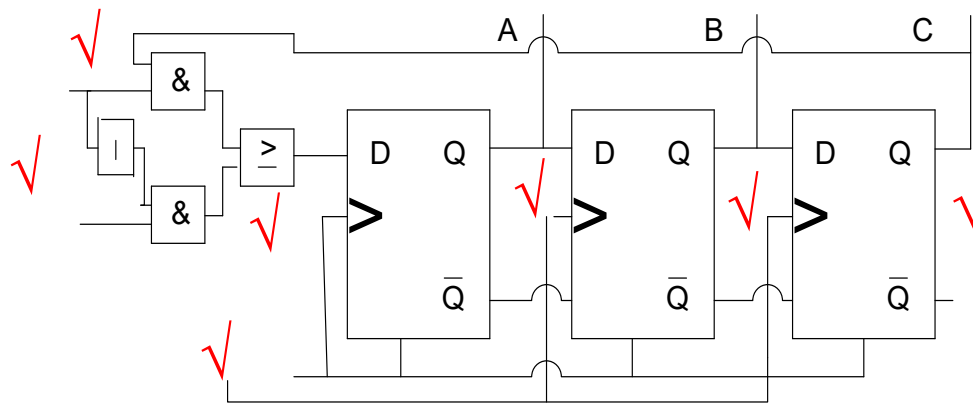


√ √ √ √

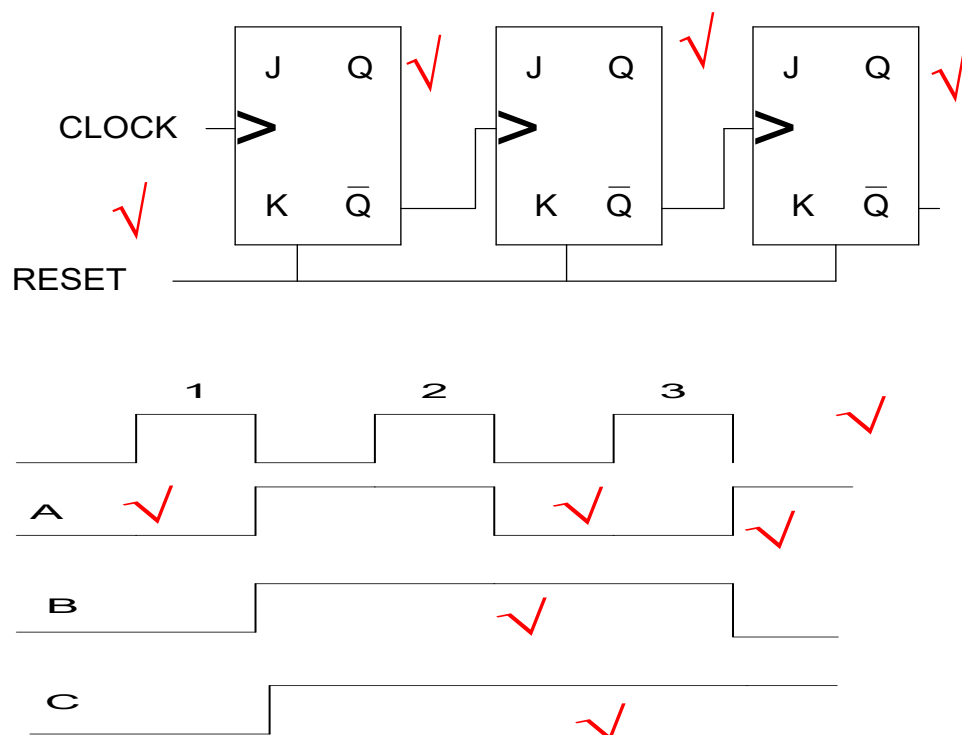
S	R	Q	$\overline{Q}$
0	0	Q	$\overline{Q}$
0	1	0	1
1	0	1	0
1	1	*	*

(10)

4.2

(7)
[15]**QUESTION 5**

5.1



(10)

5.2

	C	B	A
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	0	0	0

(10)
[20]

TOTAL: 100