higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

NOVEMBER EXAMINATION

LOGIC SYSTEMS N4

28 NOVEMBER 2016

This marking guideline consists of 9 pages.

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QUESTION 1

1.1 Temporary memory (1)

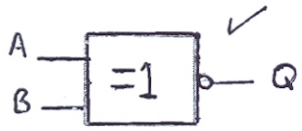
1.2 Analogue signal output (1)

1.3 Binary-coded decimal (1)

1.4 2421_{BCD} (1)

1.5 $Q = \overline{B \oplus C}$ ✓

A	B	Q
0	0	1
0	1	0
1	0	0
1	1	1



(3)

1.6 Hamming code (1)

1.7 1.7.1 1

1.7.2 A + B

(2 × 1) (2)

1.8 1.8.1 Free-running

1.8.2 Two-state

1.8.3 Single-state

(3 × 1) (3)

1.9
- To be fast-switching
- To produce a square-wave output (2)

1.10 1.10.1 ✓ ✓ ✓

$F,C_{16} = 1111,1100_2 = \mathbf{17,60_8}$ (3)

1.10.2 ✓ ✓ ✓

$12,125_{10} = 1100,001_2 = \mathbf{C,2_{16}}$ (3)

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QUESTION 2

2.1 2.1.1

$7,5_8 = 111,101_2$ ✓✓

$9,125_{10} = 1001,001$ TWO'S COMPLEMENT

$0111,101_2$ ✓
$0110,111_2$ ✓
$1110,100_2$ ✓

NO CARRY GETS TWO'S COMPLEMENT $_{1PL}$**$-0001,100_2 = -1,4_8$** ✓

2.1.2

$E,5_{16} \times 2,375_{10}$
$E,5_{16} = 1110,0101_2$ ✓
$2,375_{10} = 10,011_2$ ✓

1110,0101
x10,011
11100101 ✓
111001010 ✓
111001010000 ✓
$100001,1111111_2 =$ **$21,FE_{16}$** ✓

2.1.3

$A,C_{16} \div 2,3_8$
$A,C_{16} = 1010,1100$ ✓
$2,3_8 = 10,011$ ✓ ✓

$100,1000_2 =$ **$4,4_8$** ✓

$$10011\ \overline{)1010110,0000}$$
10011
00010100 ✓
10011
00001000 ✓

(3 × 6) (18)

2.2

1	2	3	4	5	6	7
P1	**P2**	D1	**P3**	D2	D3	D4
0	0	1	1	1	0	1

✓

P1 = 1 ,3 ,5, 7 x 1 ✓

P2 = 2 ,3 ,6, 7 ok 0 ✓

P3 = 4, 5, 6, 7 x 1 ✓ bit 5 wrong

Corrected RX = **$0011001_{hamming}$** ✓

Original data = **1001_2** ✓

(6)
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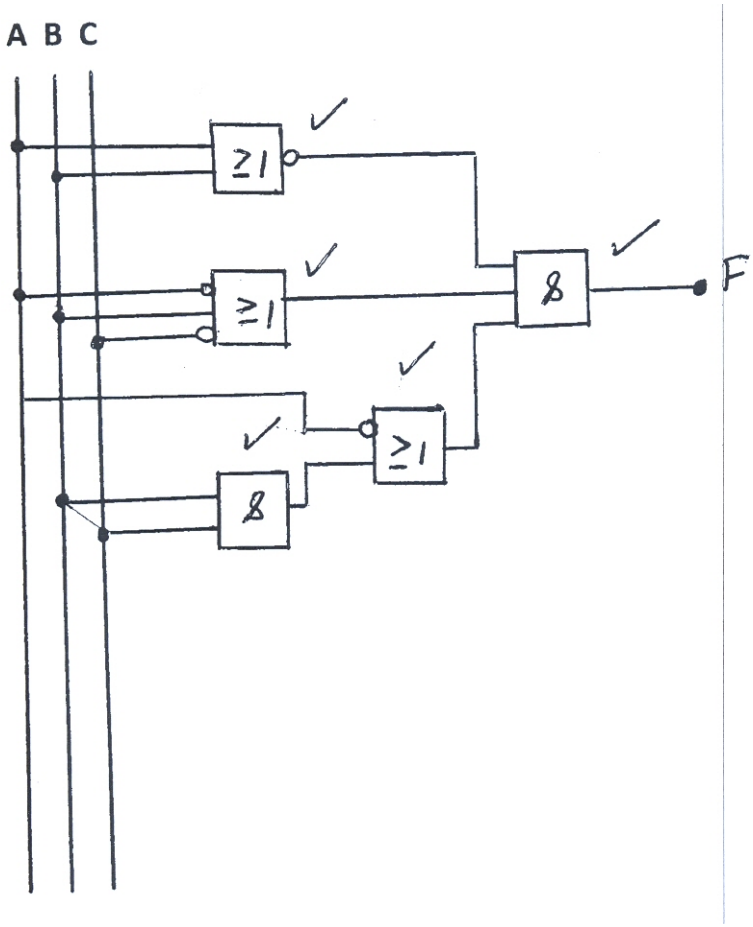
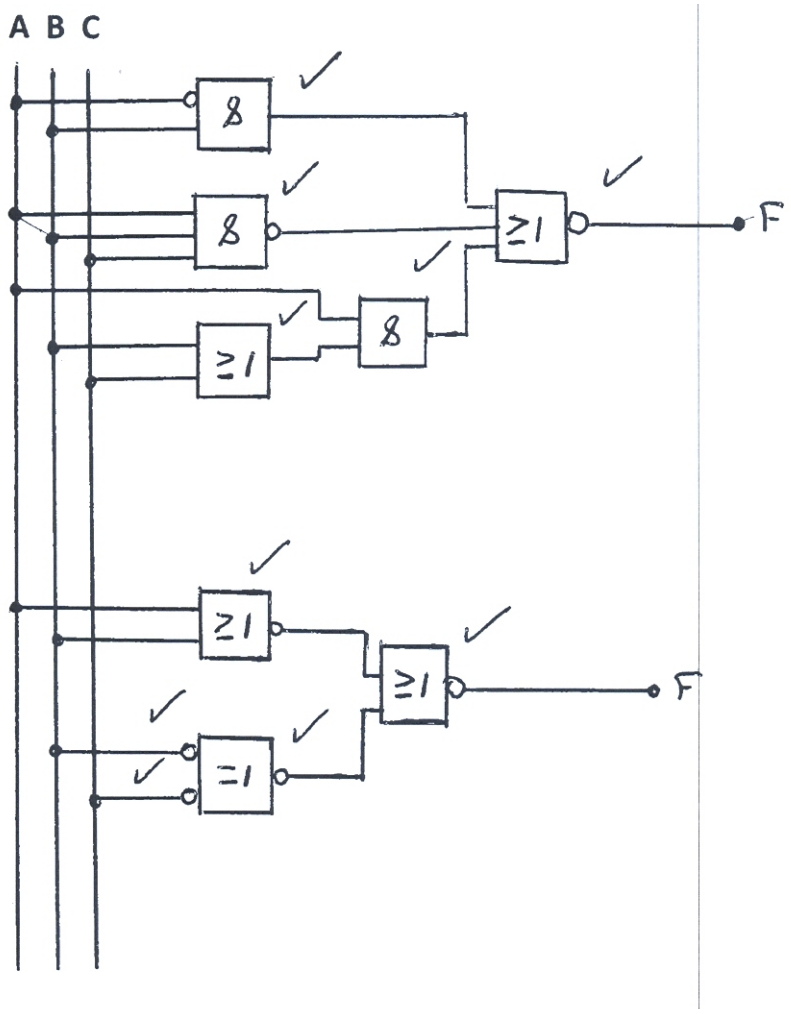
QUESTION 3

3.1 3.1.1



3.1.2



3.1.3

(3 × 5) (15)

3.2 3.2.1

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

$(A+AB+AC)(\overline{B}+\overline{C})(\overline{A}+B+C)$ ✓

$A(\overline{B}+\overline{C})(\overline{A}+B+C)$ ✓

$(A\overline{B}+A\overline{C})(\overline{A}+B+C)$

$0+0+A\overline{B}C+0+AB\overline{C}+0$ ✓

$A(\overline{B}C+B\overline{C})$ ✓

$A(B\oplus C)$ ✓

3.2.2

$AB+\overline{\overline{A}BC+A\overline{B}+\overline{A}C}=F$

$AB+\overline{\overline{A}BC}.\overline{A\overline{B}}.\overline{\overline{A}C}$ ✓

$AB+(A+\overline{B}+C).(\overline{A}+B).(A+\overline{C})$ ✓

$AB+(0+AB+\overline{A}.\overline{B}+0+\overline{A}C+BC).(A+\overline{C})$ ✓

$AB+AB+0+0+ABC+AB\overline{C}+\overline{A}.\overline{B}.\overline{C}+0+0$ ✓

$AB+\overline{A}.\overline{B}.\overline{C}$ ✓

(2 × 5) (10)
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QUESTION 4

GRAY CODE 2421- BCD CODE

A	B	C	D		F1	F2	F3	F4
0	0	0	0		0	0	0	0
0	0	0	1		0	0	0	1
0	0	1	1		0	0	1	0
0	0	1	0		0	0	1	1
0	1	1	0		0	1	0	0
0	1	1	1		1	0	1	1
0	1	0	1		1	1	0	0
0	1	0	0		1	1	0	1
1	1	0	0		1	1	1	0
1	1	0	1		1	1	1	1
1	1	1	1		X	X	X	X
1	1	1	0		X	X	X	X

1	0	1	0		X	X	X	X
1	0	1	1		X	X	X	X
1	0	0	1		X	X	X	X
1	0	0	0		X	X	X	X

F1

	$\bar{A}\bar{B}$	$\bar{A}B$	AB	$A\bar{B}$
$\bar{C}\bar{D}$	0	1	1	x
$\bar{C}D$	0	1	1	x
CD	0	1	x	x
$C\bar{D}$	0	0	x	x

$$f_1 = B\bar{C} + BD \checkmark$$
$$= \overline{\overline{B\bar{C} + BD}}$$
$$= \overline{\overline{B\bar{C}} \cdot \overline{BD}} \checkmark$$

F2

	$\bar{A}\bar{B}$	$\bar{A}B$	AB	$A\bar{B}$
$\bar{C}\bar{D}$	0	1	1	x
$\bar{C}D$	0	1	1	x
CD	0	0	x	x
$C\bar{D}$	0	1	x	x

$$f_2 = B\bar{C} + B\bar{D} \checkmark$$
$$= \overline{\overline{B\bar{C} + B\bar{D}}}$$
$$= \overline{\overline{B\bar{C}} \cdot \overline{B\bar{D}}} \checkmark$$

F3

	$\bar{A}\bar{B}$	$\bar{A}B$	AB	$A\bar{B}$
$\bar{C}\bar{D}$	0	0	1	x
$\bar{C}D$	0	0	1	x
CD	1	1	x	x
$C\bar{D}$	1	0	x	x

$$f_3 = A + \bar{B}C + CD \checkmark$$
$$= \overline{\overline{A + \bar{B}C + CD}}$$
$$= \overline{\bar{A} \cdot \overline{\bar{B}C} \cdot \overline{CD}} \checkmark$$

F4

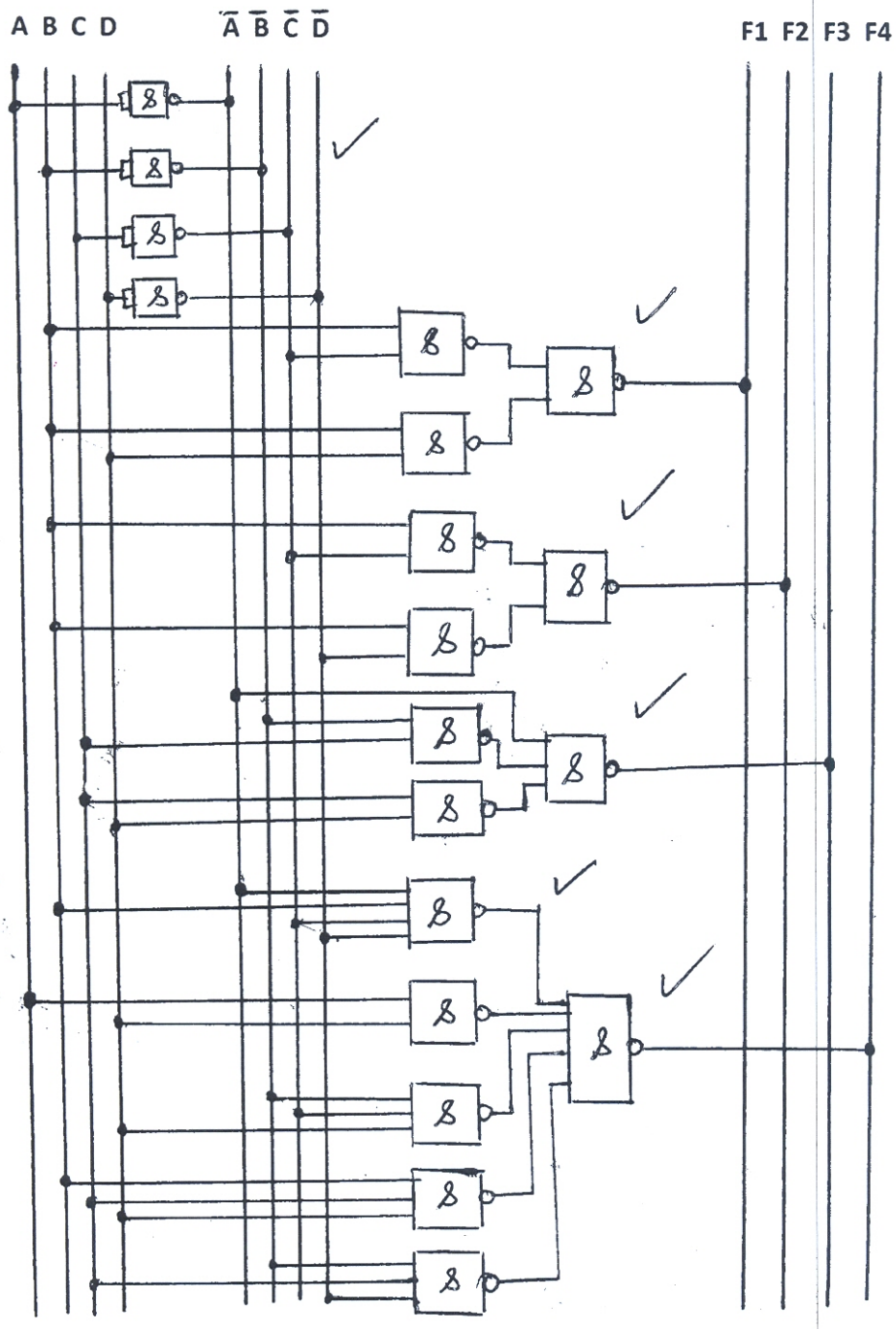
	$\bar{A}\bar{B}$	$\bar{A}B$	AB	$A\bar{B}$
$\bar{C}\bar{D}$	0	1	0	x
$\bar{C}D$	1	0	1	x
CD	0	1	x	x
$C\bar{D}$	1	0	x	x

$$f_4 = \bar{A}B\bar{C}\bar{D} + AD + \bar{B}\bar{C}D + BCD + \bar{B}C\bar{D}$$

$$= \overline{\bar{A}B\bar{C}\bar{D} + AD + \bar{B}\bar{C}D + BCD + \bar{B}C\bar{D}}$$

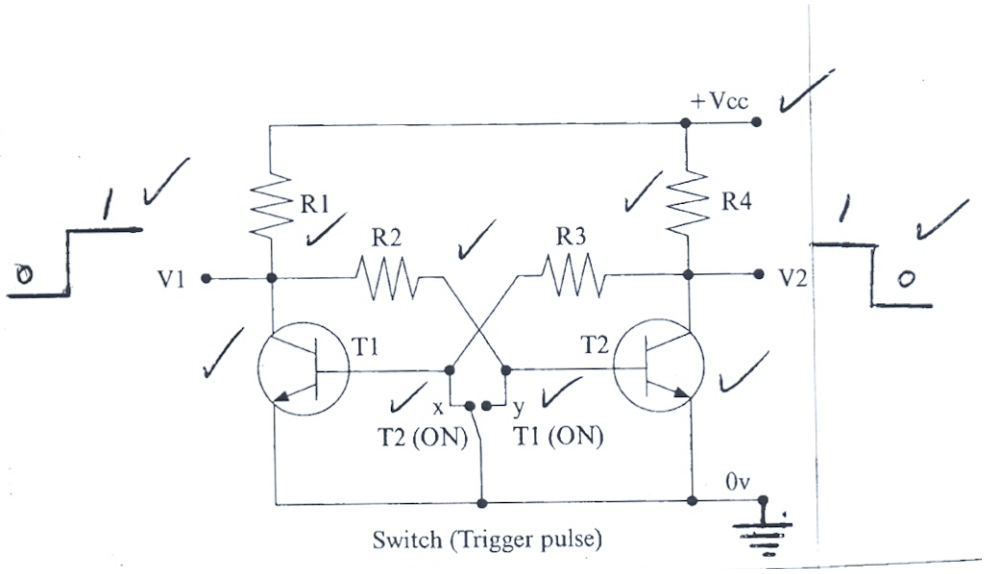
$$= \overline{\bar{A}B\bar{C}\bar{D}} \cdot \overline{AD} \cdot \overline{\bar{B}\bar{C}D} \cdot \overline{BCD} \cdot \overline{\bar{B}C\bar{D}}$$

GRAY Code **2421- BCD Code**



[20]

QUESTION 5



[10]

TOTAL: 100

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