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higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T960(E)(N19)T
NOVEMBER EXAMINATION

NATIONAL CERTIFICATE

LOGIC SYSTEMS N4

(8080284)

19 November 2013 (X-Paper)
09:00–12:00

Calculators may NOT be used.

This question paper consists of 6 pages.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
LOGIC SYSTEMS N4
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Keep subsections of questions together.
5. Rough calculations may be done at the back of the ANSWER BOOK.
6. Write neatly and legibly.

QUESTION 1

Choose a/an item/word from COLUMN B that matches a description in COLUMN A. Write only the letter (A–JJ) next to the question number (1.1–1.25) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1	Non weighed self-inverting code	A	EBSDIC
1.2	Error detection and correction code used in data transmission	B	astable
1.3	Alpha-numeric number system using 4 bits	C	binary
1.4	Equality comparator gate	D	R-S Master-slave flip flop
1.5	2421 CODE	E	8
1.6	Two's compliment of $1101,0111_2$	F	hexadecimal
1.7	Flip-flop with undetermined state	G	X-3 BCD
1.8	Circuit which provides for fast switching times on an input waveform	H	AIKEN CODE
1.9	Radix of the hexadecimal system	I	$0010,1001_2$
1.10	Grouping possibilities on a Karnaugh map with 4-variables	J	JK master slave flip flop
1.11	This type of logic gate has multi-emitter input transistors	K	XOR- gate
1.12	Another name for a single state multivibrator	L	AND gate
1.13	This multivibrator can be used as a clock generator	M	NOT gate
1.14	This type of multivibrator requires an external Input to store either a '1' or a '0'	N	ASCII code
1.15	This grouping on a Karnaugh map should never be used	O	astable multivibrator
1.16	$\overline{XY} + \overline{CD} = \overline{XYCD}$ is an application of this law	P	octal
		Q	OR gate
		R	NOR gate
		S	Gray code
		T	as large as possible
		U	diagonal
		V	De-Morgan's

<table>
<tr><td>1.17</td><td>Given:
<table><tr><th>A</th><th>B</th><th>Q</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table>Is the truth table for this gate</td><td>W</td><td>1,2,4,8,16</td></tr>
<tr><td>1.18</td><td>$\overline{X}Y + X\overline{Y}$ Is the Boolean expression of this type of gate</td><td>X</td><td>TTL</td></tr>
<tr><td>1.19</td><td>This logic gate function is given by the common-emitter single transistor switching circuit</td><td>Y</td><td>ECL</td></tr>
<tr><td>1.20</td><td>This is a positional code used in data transmission</td><td>Z</td><td>monostable</td></tr>
<tr><td>1.21</td><td>This number system converts into groups of FOUR binary bits from 0 to 9 decimal only</td><td>AA</td><td>bistable</td></tr>
<tr><td>1.22</td><td>This code is used when data from the keyboard is transferred into the computer</td><td>BB</td><td>Hamming code</td></tr>
<tr><td>1.23</td><td>This number system is used by computers</td><td>CC</td><td>8421 BCD code</td></tr>
<tr><td>1.24</td><td>This flip-flop has a natural toggle action</td><td>DD</td><td>X-NOR gate</td></tr>
<tr><td>1.25</td><td>This gate will only provide an output when all inputs are at binary 0</td><td>EE</td><td>$0010,1000_2$</td></tr>
<tr><td></td><td></td><td>FF</td><td>Schmitt-trigger</td></tr>
<tr><td></td><td></td><td>GG</td><td>RS master slave</td></tr>
<tr><td></td><td></td><td>HH</td><td>2,4,8</td></tr>
<tr><td></td><td></td><td>II</td><td>NAND gate</td></tr>
<tr><td></td><td></td><td>JJ</td><td>Boole's law</td></tr>
</table>

(25 x 1) **[25]**

QUESTION 2

2.1 Do the following calculations in the binary system. Show ALL conversions and calculations clearly:

$14,75_{10} - 26,5_8$

Make use of the one's compliment method and convert the final answer to the decimal system. (6)

2.2 $3C,E_{16} \div 10,5_{10}$

Convert the final answer to the octal system. (6)

2.3 $B,D_{16} \times 3,2_8$

Convert the final answer to the hexadecimal system. (6)

2.4 Write $92,8_{10}$ in the following codes:

2.4.1 2421 BCD

2.4.2 Excess – 3 BCD

(2 x 3) (6)
[24]

QUESTION 3

3.1 Draw the circuit diagrams of the Boole expressions below without changing or simplifying them:

3.1.1 $\overline{\overline{B} + AB\overline{C} + \overline{\overline{B}\,\overline{C}}} + A \oplus C = f(A, B, C)$

3.1.2 $\overline{(A+\overline{B})(\overline{B}+C)} \oplus \overline{A}C = F(A, B, C)$

(2 x 5) (10)

3.2 Simplify the expressions below to their simplest forms. Convert the simplified answers to NAND gates and draw the circuits.

3.2.1 $\overline{\overline{(A\overline{B}\,\overline{C} + B\overline{C})(\overline{A}\,\overline{B} + \overline{\overline{A}B\overline{C}})(\overline{B\overline{C} + A\overline{\overline{B}\,\overline{C}}})}} = F(A, B, C)$

3.2.2 $A\overline{BC} + \overline{A}B\overline{C} + \overline{ABC} + \overline{AB}C = F(A, B, C)$

(2 x 8) (16)
[26]

QUESTION 4

Design a code converter which will convert the functions below to their respective outputs (F1, F2, F3 and F4). Use Karnaugh maps, De Morgan, and show the conversion to minimum NAND gates. Then draw the circuit diagram using NAND gates only.

F1 (A,B,C,D) = $\sum$ (8, 9, 10, 11, 12) + Φ (0, 1, 2, 13, 14, 15)
F2 (A,B,C,D) = $\sum$ (7, 9, 10, 11, 12) + Φ (0, 1, 2, 13, 14, 15)
F3 (A,B,C,D) = $\sum$ (5, 6, 8, 11, 12) + Φ (0, 1, 2, 13, 14, 15)
F4 (A,B,C,D) = $\sum$ (4, 6, 8, 10, 12) + Φ (0, 1, 2, 13, 14, 15)

[20]

QUESTION 5

Make a neat labeled sketch of an astable multivibrator which makes use of NPN transistors. Also clearly show the outputs.

[5]

TOTAL: 100