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higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T950(E)(A5)T
APRIL EXAMINATION

NATIONAL CERTIFICATE

LOGIC SYSTEMS N4

(8080284)

5 April 2013 (X-Paper)
09:00–12:00

Calculators may NOT be used.

This question paper consists of 4 pages.

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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 work may be done at the back of the ANSWER BOOK.
6. Write neatly and legibly.

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QUESTION 1

1.1 Write down the symbols of the binary system. (1)

1.2 What is the base of the octal system? (1)

1.3 Give the Boole expressions of De Morgan's TWO theorems. (2)

1.4 Give the symbol, truth table and Boole expression of the NOR gate. (3)

1.5 State FIVE requirements for grouping a Karnaugh map. (5)

1.6 Give the symbol, truth table and Boole expression for an equality comparator gate. (3)

1.7 Give the simplest form of the Boolean expressions below:

1.7.1 $A + A\overline{B} + AB\overline{C}$ (1)

1.7.2 $A + ABC + 1$ (1)

1.8 Give the symbols and truth tables of the following master/slave flip flops:

JK
RS
D-TYPE (9)

[26]

QUESTION 2

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

$15{,}6_8 - 17{,}25_{10}$

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

2.2 $E{,}5_{16} \times 2{,}375_{10}$

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

2.3 $A{,}C_{16} \div 2{,}3_8$

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

2.4 Use a table and show ALL the steps to detect and correct a possible error in the following Hamming code word received:

0011101_{Hamming} (6)

[24]

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QUESTION 3

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

3.1.1 $\overline{(A+B)}\ \ (\overline{A}+\mathrm{B}+\overline{C})(\overline{A}+\mathrm{C}) = \mathrm{f}$

3.1.2 $\overline{\overline{AB}+\overline{ABC}+A\overline{BC}} = \mathrm{F}$

3.1.3 $\overline{\overline{A+B}+\overline{B}\oplus\overline{C}} = \mathrm{F}$

(5 × 3) (15)

3.2 Simplify the expressions below to their simplest forms:

3.2.1 $\mathrm{A}(\mathrm{A+B+C})(\overline{B}+\overline{C})(\overline{A}+\mathrm{B}+\mathrm{C}) = \mathrm{f}$ (4)

3.2.2 $\mathrm{AB}+\overline{\overline{AB}\overline{C}+A\overline{B}+\overline{A}C}$ (6)

[25]

QUESTION 4

Design a code converter which will convert the Gray code (A, B, C, D) to the 2421 BCD code (F1, F2, F3, F4). Use Karnaugh maps and show the conversion to NAND gates. Then draw the circuit diagram using NAND gates only. **[16]**

QUESTION 5

Make a neat labelled sketch of a Schmitt trigger which makes use of NPN transistors. Also clearly show how a sine wave can be converted to a square wave by this circuit. **[9]**

TOTAL: 100

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