higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T880**(E)**(A8)T

APRIL EXAMINATION

NATIONAL CERTIFICATE

LOGIC SYSTEMS N4

(8080284)

8 April 2016 (X-Paper)
9:00–12:00

Calculators may not be used.

This question paper consists of 5 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
LOGIC SYSTEMS N4
(First Paper)
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 ALL the subsections of questions together.
5. Rough calculations may be done at the back of the ANSWER BOOK.
6. Write neatly and legibly.

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QUESTION 1

1.1 Name the function of the hard disk drive in your home computer. (1)

1.2 Name TWO main types of memory used in your home computer. (2)

1.3 De Morgan developed a theorem which replaces different logic gates with only NAND gates as building blocks.

Give the Boolean expressions of De Morgan's two theorems. (2)

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

1.5 List FIVE requirements to follow when grouping a Karnaugh map. (5)

1.6 Give the simplest form of the Boolean expressions below:

1.6.1 $A + A\overline{B} + AB\overline{C} + ABC$

1.6.2 $A + ABC + 1 + AB$

(2 × 1) (2)

1.7 Draw the symbols of the following master/slave flip-flops and show the external connections necessary to make each one toggle:

1.7.1 J-K

1.7.2 RS

1.7.3 D-type (7)

[22]

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QUESTION 2

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

2.1.1 $7{,}5_8 - 9{,}125_{10}$

Make use of the two's compliment method and convert the final answer to the octal number system.

2.1.2 $11{,}375_{10} \times 5{,}2_8$

Convert the final answer to the octal number system.

2.1.3 $14{,}125_{10} \div 6{,}4_8$

Convert the final answer to the decimal number system.

(3 × 6) (18)

2.2 Use a table and show all the steps to transmit the following data word in the Hamming code word over the internet on your cell phone:

Data = 5_{10} (6)

[24]

QUESTION 3

3.1 Circuit diagrams are needed by engineers doing repairs on circuit boards.

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

3.1.1 $\overline{(\overline{A}+\overline{B})} + \overline{A} + B + \overline{C})\,(\overline{A}+BC) = F$

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

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

(3 × 5) (15)

3.2 Simplify the expressions below to their simplest forms:

3.2.1 $\overline{(\overline{A}BC + A\overline{B}C)}\,\overline{(AB\overline{C} + ABC)} = F$ (6)

3.2.2 $\overline{(AB\overline{C} + A\overline{B})(\overline{A}B + A\overline{B}C) + (AB\overline{C} + A\overline{B})} = F$ (4)

[25]

QUESTION 4

Design a code converter for the Telkom satellite link connection to Asia which will convert the 8421 code (A, B, C, D) to the X-3 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. **[20]**

QUESTION 5

Make a neat labelled sketch of a J-K masterslave flip-flop which consists of only NAND gates. **[9]**

TOTAL: 100

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