higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T940**(E)**(A2)T

NATIONAL CERTIFICATE

LOGIC SYSTEMS N4

(8080284)

2 August 2018 (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. Use only BLUE or BLACK ink.
5. Start each question on a NEW page.
6. Keep subsections of questions together.
7. Do ALL drawings with a pencil.
8. ALL sketches and diagrams must be large, clear and neat.
9. Show ALL calculations.
10. Write neatly and legibly.

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QUESTION 1

1.1 Name the FOUR basic operations of the CPU in your home computer. (4)

1.2 How many combinations can be used on a three-input OR gate? (1)

1.3 Convert the Gray code 1110011 to its binary equivalent. (1)

1.4 Give a reason why a parity bit is added to data which is sent via a digital system. (2)

1.5 Simplify the Boolean expressions below:

1.5.1 $ABC + A\overline{B}\overline{C} + 1$

1.5.2 $A + BCD + \overline{A} + CD$

1.5.3 $A\overline{B} + A\overline{B}\overline{C} + \overline{B}$

1.5.4 $ABC + \overline{\overline{A}\overline{B}\overline{C}} + BC$

(4 × 1) (4)

1.6 Draw the truth table and the IEC symbol of the equality comparator. (3)

1.7 Draw the IEC symbol and the truth table of each of the following flip-flops:

1.7.1 SR

1.7.2 D-Type

1.7.3 JK

(3 × 2) (6)
[21]

QUESTION 2

2.1 Convert each of the following numbers to their BINARY equivalents and then complete the calculations in the binary number system. Show all conversions.

2.1.1 Use the two's complement method to subtract $6{,}25_{10}$ from $2C{,}5_{16}$. Convert the final answer to the decimal numbering system.

2.1.2 $12{,}125_{10} \times 5{,}4_{8}$

Convert the final answer to the hexadecimal system.

2.1.3 $B_{16} \div 4_{8}$

Convert the final answer to the octal system

(3 × 6) (18)

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2.2 Convert $8{,}65_{10}$ to the following codes:

2.2.1 8421 BCD

2.2.2 Excessive -3 code

2.2.3 2421 BCD

(3 × 3) (9)

2.3 The message 'Big' is to be sent by means of a data line. The system makes use of the EBCDIC code.

What is the binary equivalent of this message? (6)
[33]

QUESTION 3

3.1 Draw the circuit diagram of the Boolean expressions below. Do NOT change or simplify the expressions:

3.1.1 $F=\overline{\overline{A}BC}+(\overline{\overline{A}BC}+B)+(\overline{A\oplus B})A\overline{C}$ (8)

3.1.2 $F=\overline{\overline{\overline{A}+B}+\overline{B\oplus C}}$ (5)

3.2 Write down a simplified expression/s for the equations below:

3.2.1 $F=AB+\overline{\overline{A}B\overline{C}+A\overline{B}+\overline{A}C}$

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

(2 x 6) (12)
[25]

QUESTION 4

One of the codes that are used in the military for security purposes is a Gray code. For security reasons, this code is supposed to be changed on an annual basis.

Design a code converter which will convert the Gray code (A, B, C, D) to the 8421 BCD code (F1, F2, F3, F4). Use Karnaugh maps and show the conversion to NAND gates. Hence, draw the circuit diagram using NAND gates only. **[15]**

QUESTION 5

Make a neat labelled sketch of a mono-stable multivibrator using NPN transistors. **[6]**

TOTAL: 100

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