higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

ENGINEERING

T850(E)(J29)T
AUGUST EXAMINATION

NATIONAL CERTIFICATE

LOGIC SYSTEMS N3

(8080273)

29 July 2014 (Y-Paper)
13:00–16:00

Calculators may NOT be used.

This question paper consists of 8 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
LOGIC SYSTEMS N3
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. Write neatly and legibly.

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SECTION A

QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1.1–1.1.10) in the ANSWER BOOK.

1.1.1 The weight of the LSB as a binary number is:

A 1
B 2
C 3
D 4

1.1.2 A BCD code that represents each digit of a decimal number by a binary number derived by adding 3 to its 4-bit true binary value is …

A 9's complement code.
B excess-3 code.
C 8 421 code.
D Gray code.

1.1.3 The logic gate that will have HIGH or "1" at its output when any one of its inputs is HIGH is a(n):

A OR gate
B AND gate
C NOR gate
D NOT gate

1.1.4 The basic logic gate whose output is the complement of the input is the:

A OR gate
B AND gate
C INVERTER gate
D Comparator

1.1.5 A J-K flip-flop is in a "no change" condition when …

A J = 1, K = 1
B J = 1, K = 0
C J = 0, K = 1
D J = 0, K = 0

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1.1.6 How many flip-flops are required to construct a decade counter?

A 10
B 8
C 5
D 4

1.1.7 The bit sequence 0010 is serially entered (right-most bit first) into a 4-bit parallel-out shift register that is initially clear. What are the Q outputs after two clock pulses?

A 0000
B 0010
C 1000
D 1111

1.1.8 How can parallel data be taken out of a shift register simultaneously?

A Use the *Q* output of the first FF
B Use the *Q* output of the last FF
C Tie all of the *Q* outputs together
D Use the *Q* output of each FF

1.1.9 What is the meaning of RAM, and what is its primary role?

A Readily Available Memory; it is the first level of memory used by the computer in all of its operations
B Random Access Memory; it is memory that can be reached by any subsystem within a computer, and at any time
C Random Access Memory; it is the memory used for short-term temporary data storage within the computer
D Resettable Automatic Memory; it is memory that can be used and then automatically reset, or cleared, after being read from or written to

1.1.10 What input values will cause an AND logic gate to produce a HIGH output?

A At least one input is HIGH
B At least one input is LOW
C All inputs are HIGH
D All inputs are LOW

(10 × 1) (10)

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1.2 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.2.1–1.2.10) in the ANSWER BOOK.

1.2.1 A parallel-in/serial-out shift register enters all data bits simultaneously and transfers them out one bit at a time.

1.2.2 A ripple counter is an asynchronous counter.

1.2.3 The *Q* output of a flip-flop is normally HIGH when the device is in the "CLEAR" or "RESET" state.

1.2.4 The exclusive-NOR (XNOR) gate is simply an OR gate followed by a NOT gate.

1.2.5 8 421 codes is an ASCII code.

1.2.6 The binary equivalent of octal number 43 is 10111.

1.2.7 NOT gate has one input and one output.

1.2.8 Half adder is an arithmetic element which can add two binary digits.

1.2.9 In the Gray code, each number is 3 greater than the binary representation of that number.

1.2.10 EEPROM and Flash memory are electrically erasable.

(10 × 1) (10)

1.3 Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–E) next to the question number (1.3.1–1.3.5) in the ANSWER BOOK.

COLUMN A		COLUMN B
1.3.1	it allows the user to choose the data and program it onto the memory	A DRAM
1.3.2	it forms part of the central computer	B SRAM
1.3.3	it is a type of random-access memory that stores each bit of data in a separate capacitor within an integrated circuit	C CD-ROM
1.3.4	it works on the principle of the laser beam	D PROM
1.3.5	it is a type of semiconductor memory that uses bistable latching circuitry to store each bit	E Main memory

(5 × 1) (5)

[25]

TOTAL SECTION A: 25

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SECTION B

QUESTION 2

2.1 The FIGURE below shows the IEC symbol of two different arithmetic elements.

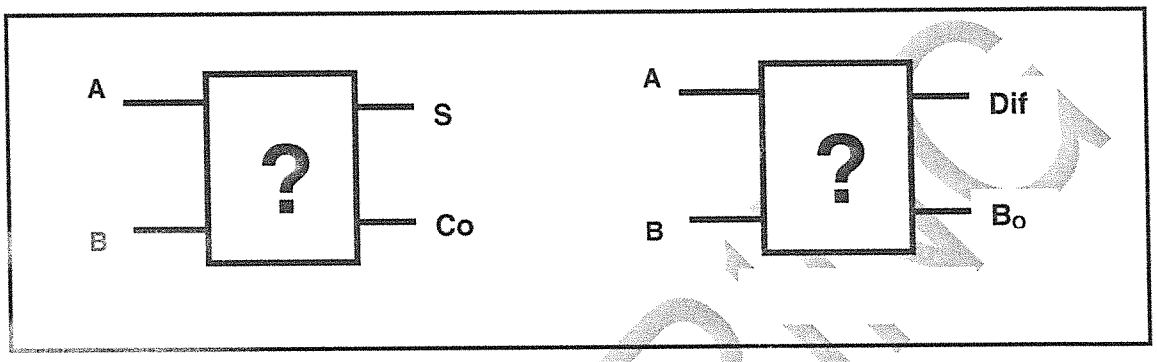

FIGURE 1(a) **FIGURE 1(b)**

2.1.1 Identify the arithmetic elements in FIGURE1 (a) and 1(b) above. (2)

2.1.2 Compile the truth table for the IEC symbol in FIGURE 1(b) above. (3)

2.1.3 Draw a logic circuit for the IEC symbol in FIGURE 1(a) above using only TWO gates. (4)

2.2 If the binary code of 4_{10} is 0100_2, then what is the excess 3(EX3) code of 4_{10}? (2)

2.3 By making use of 9's complement subtract 100_{10} from 63_{10}. (3)

2.4 Multiply 1010_2 by 20_8 by making use of binary multiplication and then convert your binary answer to the hexadecimal number system. (4)

2.5 Divide 30_{16} by 12_{10} and then convert your binary answer to the octal number system. (5)

2.6 The following is received at the end of a transmission data line. Even parities are used. Determine whether any faults occurred during transmission and if so, rectify the fault(s).

1 0 1 1 1 0 1 1
1 0 0 0 1 0 1 1
1 1 1 0 0 0 0 0
1 0 1 0 1 1 0 0
1 0 0 0 0 1 1 1
1 1 1 1 1 1 1 1

(7)
[30]

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QUESTION 3

3.1 Study and analyse the conditions written below.

(a) When switch A and switch B are both OPEN, the lamp is OFF.
(b) When switch A is CLOSED, and switch B is OPEN the lamp is still OFF.
(c) When switch A is OPEN, and switch B is CLOSED the lamp is still OFF.
(d) When switch A and switch B are both CLOSED, then the lamp is ON.

3.1.1 From the conditions above compile the truth-table. (3)

3.1.2 What logic function can summarise the conditions above? (2)

3.1.3 Draw the IEC symbol for the logic function in QUESTION 3.1.2. (2)

3.2 Briefly explain why NOT gate is called inverter. (2)

3.3 What is the meaning of the following with reference to an integrated circuit (IC)?

3.3.1 LSI

3.3.2 CMOS

3.3.3 ECL

(3 × 2) (6)
[15]

QUESTION 4

4.1 Every clock pulse has a leading edge and a trailing edge.

By means of a negative clock pulse show the difference between a trailing and leading edge. (4)

4.2 Sometimes it becomes difficult to select or buy memory devices for our personal computers.

Name FIVE characteristics that one needs to consider when selecting or buying different memories. (5)

4.3 By means of IEC symbols show the difference between a clocked RS flip-flop and RS master/slave flip-flop. (6)
[15]

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QUESTION 5

5.1 Explain the following terms:

5.1.1 Up-counter

5.1.2 Up/down-counter

5.1.3 Ripple counter (3 × 2) (6)

5.2 Two commonly used register counters in digital logic are the circulating shift registers (ring counter and Johnson counter).

5.2.1 Why is the Johnson counter called a twisted ring counter? (2)

5.2.2 Draw a schematic block diagram of a 4-bit ring counter. (5)

5.3 How many flip-flops are required in a shift register to delay the flow of data by five clock pulses? (2)
[15]

TOTAL SECTION B: 75
GRAND TOTAL: 100

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