

higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

**T850(E)(A1)T
APRIL EXAMINATION
NATIONAL CERTIFICATE**

LOGIC SYSTEMS N3

(8080273)

**1 April 2014 (Y-Paper)
13:00–16:00**

Calculators may NOT be used.

This question paper consists of 8 pages.

**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 (1.1.1–1.1.9) in the ANSWER BOOK.

1.1.1 The number of bits used to store a BCD digit is:

- A 8
- B 4
- C 1
- D 2

(1)

1.1.2 What is the difference between binary coding and binary-coded decimal?

- A Binary coding is pure binary
- B BCD is pure binary
- C Binary coding has a decimal format
- D BCD has no decimal format

(1)

1.1.3 What is the binary value of the decimal problem $49 + 1 = ?$

- A 01010101
- B 00110101
- C 00110010
- D 00110001

(2)

1.1.4 The output will be a LOW for any case when one or more inputs are zero in a(n):

- A OR gate
- B NOT gate
- C AND gate
- D NAND gate

(1)

1.1.5 Which statement below best describes the function of a decoder?

- A A decoder will convert a decimal number into the proper binary equivalent
- B A decoder will convert a binary number into a specific output representing a particular character or digit
- C Decoders are used to prevent improper operation of digital systems
- D Decoders are special ICs that are used to make it possible for one brand of computer to talk to another

(1)

- 1.1.6 Which input combination will make a J-K flip-flop to toggle?
A J = 0, K = 0
B J = 1, K = 0
C J = 0, K = 1
D J = 1, K = 1 (1)
- 1.1.7 Synchronous counters eliminate the delay problems encountered with asynchronous counters because the ...
A input clock pulses are applied only to the first and last stages.
B input clock pulses are applied only to the last stage.
C input clock pulses are not used to activate any of the counter stages.
D input clock pulses are applied simultaneously to each stage. (1)
- 1.1.8 On the fifth clock pulse, a 4-bit Johnson sequence is Q0 = 0, Q1 = 1, Q2 = 1, and Q3 = 1. On the sixth clock pulse, the sequence is ...
A Q0 = 1, Q1 = 0, Q2 = 0, Q3 = 0
B Q0 = 1, Q1 = 1, Q2 = 1, Q3 = 0
C Q0 = 0, Q1 = 0, Q2 = 1, Q3 = 1
D Q0 = 0, Q1 = 0, Q2 = 0, Q3 = 1 (1)
- 1.1.9 The storage element for a static RAM is the ...
A diode.
B resistor.
C capacitor.
D flip-flop. (1)
- 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 An optical disk is an example of magnetic storage.
- 1.2.2 A group of 6 bits is also known as 1 byte.
- 1.2.3 A parallel load operation is asynchronous, so it is not dependent on the clock.
- 1.2.4 A counter has a specified sequence of states, but a shift register does not.
- 1.2.5 Decimal numbers can be converted into binary by dividing by two and recording the remainders.
- 1.2.6 The most significant digit is the rightmost, largest-weight digit in a number.

- 1.2.7 ASCII codes are used strictly for representing the letters in the alphabet.
- 1.2.8 The output of an exclusive-OR (XOR) gate is 1 only when the inputs are different.
- 1.2.9 A NAND gate consists of an AND gate and an OR gate connected in series with each other.
- 1.2.10 Bidirectional shift registers can shift data either right or left.

(10 x 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 is a shift register which converts data from serial format to parallel format.	A	a bidirectional register
1.3.2	It is a shift register in which the data can be shift either left or right	B	a ring counter
1.3.3	It is a register that delays data by one clock at the time for each stage	C	a serial-in, parallel-out shift
1.3.4	It is a shift register which moves data bits from right to left	D	serial-in, serial-out shift
1.3.5	It is a circulating shift register in which the output of the most significant stage is fed back to the input of the least significant stage	E	a left-shift register

(5 x 1)

(5)
[25]

TOTAL SECTION A:

25

SECTION B**QUESTION 2**

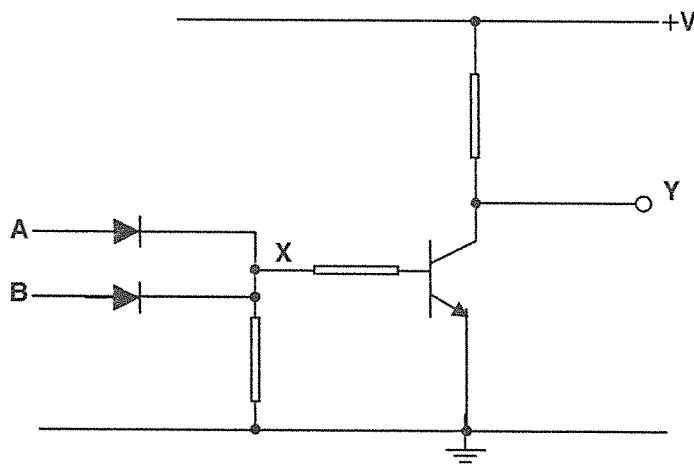
- 2.1 Show by means of IEC symbols the difference between a half subtractor and full subtractor. (4)
- 2.2 The following word contains both data and parity bits. Use Hamming code to determine if any fault occurred during the transmission process, and if so, correct it:
011001100 (7)
- 2.3 Use one's complement to subtract 110000_2 from CF_{16} , and then convert the answer to the octal number system. (5)
- 2.4 Convert each of the following non-binary numbers to their binary equivalents and then complete the calculations in the binary number system:
- 2.4.1 $37_8 \times 101_2$ (3)
- 2.4.2 $10010110_2 \div 10_{10}$ (convert your answer to decimal number systems) (4)
- 2.5 Complete the following table by making use of the codes indicated on the table. Show ALL calculations in your answer book.

BINARY STRING	4221 BCD	GRAY CODE
1100 0011 1111	2.5.1.....	2.5.2.....

(3 + 4) (7)
[30]

QUESTION 3

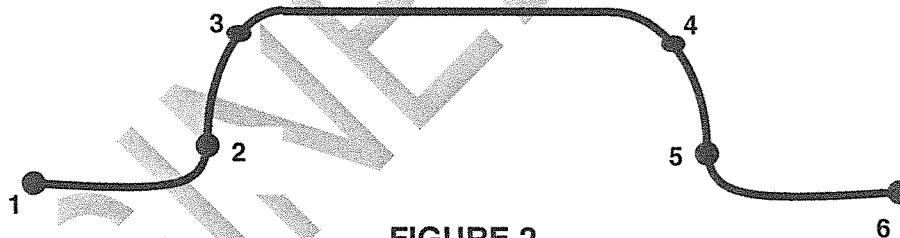
- 3.1 Study and analyse FIGURE 1 below and answer the questions.

**FIGURE 1**

- 3.1.1 What will be the logic level at point X if both inputs are zeros? (2)
- 3.1.2 What will be the logic level at point Y, if the conditions are still the same as in question 3.1.1 above? (2)
- 3.1.3 Draw the truth table for FIGURE 1 above. (3)
- 3.1.4 What logic gate is represented by FIGURE 1 above? (2)
- 3.1.5 What logic family is represented by FIGURE 1 above? (1)
- 3.2 Draw the IEC symbol for a TWO-input XNOR gate. (2)
- 3.3 Draw a switch circuit of a THREE-input NAND gate. (3)
- [15]**

QUESTION 4

- 4.1 By making use of FIGURE 2 below draw up a summarised table which shows the operation of a master-slave flip-flop.



- (6)
- 4.2 Draw an IEC symbol for a D-type master-slave flip-flop. (3)
- 4.3 A RAM has two operations performed on it.
- 4.3.1 What are those operations?
- 4.3.2 Name TWO different types of RAMs.
- 4.3.3 Why are RAMs called volatile memories?

(3 x 2) (6)
[15]

QUESTION 5

- 5.1 What is the difference between a *register* and a *shift register*? (4)
- 5.2 Why are asynchronous counters also called series counters? (2)
- 5.3 Name FOUR types of shift registers. (4)
- 5.4 Draw a neat, labelled diagram of a THREE-bit binary up-counter using JK flip-flops which triggers on a negative-edge clock transition. (5)

[15]

TOTAL SECTION B: 75
GRAND TOTAL: 100