higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

LOGIC SYSTEMS N2

(8080262)

25 November 2024 (X-paper)
09:00–12:00

Calculators may NOT be used. Drawing instruments may be used.

This question paper consists of 7 pages.

104Q1E2425

Copyright reserved

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
LOGIC SYSTEMS N2
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. All the sketches and diagrams must be large, clear and neat.
5. All calculations must be shown.
6. Use only a black or blue pen.
7. Write neatly and legibly.

Copyright reserved

QUESTION 1

1.1 MSD and LSD are the acronyms mostly used in binary number systems.

1.1.1 What do the acronyms MSD and LSD stand for? (2)

1.1.2 Briefly explain the meaning of the acronyms listed in QUESTION 1.1.1. (2)

1.2 Perform the following binary arithmetic calculations in your answer book.

1.2.1 $1001_2 \times 111_2$ (3)

1.2.2 $110001_2 \div 111_2$ (4)

1.3 Convert the answers obtained in QEUSTION 1.2.1 and 1.2.2 to decimal numbers. (2 × 2) (4)

1.4 Choose an item/word from COLUMN B that matches a description in COLUMN A. Write only the letter (A–G) next to the question number (1.4.1–1.4.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.4.1	Radix of a decimal number system is _____	A	Non-weighted codes
1.4.2	A code whereby the bits have no weight values with which they can be multiplied is called _____	B	Self-complementing code
1.4.3	A computer is operating on a principle of a number system that has a base of _____	C	2 (Two)
1.4.4	In a code, if the value of the position of every binary digit is specified, the code is called _____	D	10 (Ten)
1.4.5	The XS3 code is a non-weighted code, as well as a _____	E	Weighted codes
		F	Grey codes
		G	Excess 3 code

(5 × 1) (5)

1.5 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.5.1–1.5.5) in the ANSWER BOOK.

1.5.1 The computer only performs two functions: division and multiplication.

1.5.2 The adder is used to obtain the sum of two binary numbers.

1.5.3 To subtract two binary numbers from each other, only one full subtractor is needed.

1.5.4 If two numbers are to be subtracted, provision must be made for borrowing to a previous bit, B_{in}.

1.5.5 A half adder circuit is capable of only adding two bits.

(5 × 1) (5)

[25]

QUESTION 2

2.1 Encoding and decoding are used in many forms of communications, including computing, data communications, programming, digital electronics and human communications.

Explain the purpose of the following terms:

2.1.1 Encoder

2.1.2 Decoder

(2 × 1) (2)

2.2 List TWO non-weighted codes. (2)

2.3 Complete the following sentences by filling in the missing word or words to make the statement/s true by choosing the correct answer from the list given. Write only the word or words next to the question number (2.3.1–2.3.6) in the ANSWER BOOK.

Excess-3; 1001; Byte; 1000 0001; Bits; Three; Binary; Decimal; Four

2.3.1 Most computers store data in strings of 8 bits and is called a _____.

2.3.2 The word size is defined as the number of ___ in the binary word that a digital system operates on.

2.3.3 In a Binary Coded Decimal (BCD) system, the decimal number 81 is represented as ____.

Copyright reserved

2.3.4 To obtain excessive 3 code, a _____ is added to the decimal number and then converted to binary number.

2.3.5 To convert from the 8421 BCD code to decimal, the code number is divided into groups of _____ bits, commencing from the right.

(5 × 1) (5)

2.4 Tabulate the major differences between encoders and decoders using the stated specifications below.

Complete the table by writing only the answer next to the question number (2.4.1–2.4.4) in the ANSWER BOOK.

Specification	Encoder	Decoder
Operation	**2.4.1**	**2.4.2**
Applications	**2.4.3**	**2.4.4**

(4 × 1) (4)

2.5 Convert the number 267_{10} to the codes as indicated below:

2.5.1 8421 BCD

2.5.2 2421 BCD

2.5.3 $84\overline{21}$BCD

(3 × 4) (12)

[25]

QUESTION 3

3.1 Memories are divided into two groups, for one to be able to choose which type of memory to use, he/she needs to understand the important characteristics of those different memories.

You are required to use a table format to compare ROM and RAM memories of a computer.

List THREE characteristics per group of memory element. (3 × 2) (6)

3.2 Non-volatile memories are normally slow in speed when operating.

Give FOUR examples of non-volatile memories. (4)

3.3 Given FIGURE 1 below, draw and complete the truth table in the ANSWER BOOK. (5)

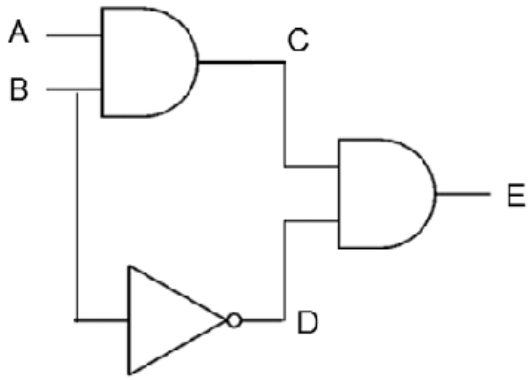


FIGURE 1

3.4 FIGURE 2 below is an IEC symbol of one of the memory elements, study the figure and answer the following questions.

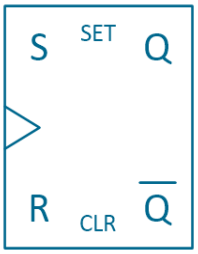


FIGURE 2

3.4.1 Which flip-flop is represented by the IEC symbol in FIGURE 2? (1)

3.4.2 Draw a logic circuit for the IEC symbol in FIGURE 2. (6)

3.5 Various options are given as possible answers to the following questions. Choose the correct answer and write only the letter (A–D) next to the question number (3.5.1–3.5.3) in the ANSWER BOOK.

3.5.1 How is a J-K flip-flop made to toggle?

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

3.5.2 Which of the following statements is correct for a D flip-flop?

A The output toggles if one of the inputs is held HIGH.
B *Q* output follows the input *D* when the enable is HIGH.
C Only one of the inputs can be HIGH at a time.
D None of the above

3.5.3 What is the standard form of T-type flip-flop?

A Both trigger and toggle.
B Trigger.
C Toggle.
D Either trigger or toggle.

(3 × 1) (3)
[25]

QUESTION 4

4.1 What are the FOUR applications of a shift register? (4)

4.2 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (4.2.1–4.2.4) in the ANSWER BOOK.

4.2.1 When a shift register is said to be parallel loaded, it simply means that all flip-flops are loaded at the same time.

4.2.2 The storage capacity of a register makes it an important type of memory.

4.2.3 A ripple counter is known as a synchronous counter.

4.2.4 Asynchronous counters have the advantage of having more components than synchronous counters and are much faster.

(4 × 1) (4)

4.3 Draw a series-in series-out shift register consisting of four JK-type flip-flops. (8)

4.4 What is the purpose of a counter in digital logic or computing? (1)

4.5 Tabulate the differences between an *asynchronous counter* and a *synchronous counter*. Give FOUR points for each counter. (8)
[25]

TOTAL: 100

Copyright reserved