higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

# NATIONAL CERTIFICATE

# LOGIC SYSTEMS N5

(8080295)

**16 April 2021 (X-paper)**
**09:00–12:00**

**Drawing instruments may be used.**

**This question paper consists of 5 pages.**

203Q1A2116

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# DEPARTMENT OF HIGHER EDUCATION AND TRAINING
# REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
LOGIC SYSTEMS N5
TIME: 3 HOURS
MARKS: 100

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**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. Fully label all circuits.
5. Draw binary registers with the most significant bit (MSB) flip-flop on the left and the least significant bit (LSB) flip-flop on the right.
6. Draw waveforms with the clock input on top followed by the LSB flip-flop output below the clock input and the MSB flip-flop output as the last output waveform on the bottom.
7. Write neatly and legibly.

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## QUESTION 1

An irrigation-control circuit requires a binary counter that counts as follows:

$4_{10}$, $6_{10}$, $7_{10}$, $3_{10}$, $1_{10}$ and $0_{10}$.

Design a synchronous binary counter that produces the above count cycle. The counter must be self-starting and must exit from any unused state to the starting state within ONE clock pulse. Design and draw the circuit by using JK master/slave flip-flops. **[15]**

## QUESTION 2

A safety circuit in a car needs to generate a count cycle as follows:

$110_2$, $101_2$, $100_2$, $011_2$, $010_2$ and $001_2$.

Draw the truth table, circuit and the input and output waveforms for an asynchronous counter that uses gated reset/set to produce the given count cycle. Use JK master/slave flips in the circuit. The truth table and waveforms must clearly show the reset action. **[15]**

## QUESTION 3

Complete the following paragraphs by writing only the missing word or words next to the question number (3.1–3.12) in the ANSWER BOOK.

In electronics, a multiplexer (or mux) is a device that selects (3.1) … of (3.2) … analogue or digital input signals and forwards the selected (3.3) … into a single line. A multiplexer of 2n inputs has n select lines that are used to select which input line to send to the output.

Multiplexers are mainly used to (3.4) … the amount of data that can be sent over the network within a certain amount of time and bandwidth. A multiplexer is also called a data selector.

An electronic multiplexer makes it possible for (3.5) … signals to share one device or resource, for example one A/D converter or one communication line, instead of having one device per input signal.

Conversely, a demultiplexer (or demux) is a device taking a single input signal and (3.6) … one of many data-output lines.

A multiplexer is often used with a complementary (3.7) … on the receiving end. An electronic multiplexer can be considered as a multiple-input, single-output (3.8) …, and a demultiplexer as a single-input, multiple-output switch.

Brief explanation of multiplexing:

A counter (sequencer) switches only one (3.9) … of several channels of the multiplexor and demultiplexor onto the transmission line at a time. A (3.10) … counter can also be used as the sequencer. Each channel has an AND gate and only one AND gate is switched on by the (3.11) … In this way several channels share the single (3.12) …

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line.

(12 × 1) **[12]**

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## QUESTION 4

4.1 Which two 4-bit binary data codes (numbers) can be regarded as both Johnson or ring-code data codes (numbers)? (2)

4.2 Draw the truth tables for both counters referred to in QUESTION 4.1 for FOUR clock pulses after switching on with $0001_2$. The $0001_2$ has been loaded prior to the clock pulses being applied. (2)

4.3 Draw the waveforms for the FOUR clock pulses in QUESTION 4.2. (9)
**[13]**

## QUESTION 5

5.1 Draw a block diagram of a typical logic divider. (8)

5.2 Explain the operation of the logic divider drawn in QUESTION 5.1. (7)
**[15]**

## QUESTION 6

Refer to the list of memory types below and write only the letter (A–G) next to the question number (6.1–6.7) in the ANSWER BOOK.

A PROM
B SRAM
C DRAM
D Hard disk
E Magnetic drum
F Magnetic core
G Magnetic tape
H None of the above

6.1 Which memory types are semiconductor types? (2)

6.2 Which memory types are volatile? (2)

6.3 Which memory types are nonvolatile? (5)

6.4 Which memory type is dynamic? (1)

6.5 Which memory types are static? (2)

6.6 Which memory types are no longer used? (2)

6.7 Which memory type requires refreshing circuits? (1)
**[15]**

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## QUESTION 7

7.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (7.1.1–7.1.6) in the ANSWER BOOK.

7.1.1 A drum printer uses a laser to print characters.

7.1.2 A thermal printer uses ordinary paper.

7.1.3 Plotters are used to print large images onto large sheets of paper.

7.1.4 A dot-matrix printer prints a complete preformed character at a time with each pin strike.

7.1.5 Impact type printers are generally slow printers.

7.1.6 A thermal printer prints characters as a matrix of dots.

(6 × 1) (6)

7.2 Indicate which of the following printers are impact printers or non-impact printers. Write only 'Impact' or 'Non-impact' next to the question number (7.2.1–7.2.5) in the ANSWER BOOK.

7.2.1 Thermal printer

7.2.2 Type-roll (drum) printer

7.2.3 Inkjet printer

7.2.4 Dot-matrix printer

7.2.5 Character-at-a-time printer

(5 × 1) (5)

7.3 Explain the similarity between a dot-matrix printer and a thermal-type printer. (2)

7.4 Explain the similarity between a drum printer and a chain (belt) type printer. (2)

**[15]**

**TOTAL: 100**

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