higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T830**(E)**(N29)T

**NOVEMBER EXAMINATION**

**NATIONAL CERTIFICATE**

# LOGIC SYSTEMS N6

(8080306)

**29 November 2016 (X-Paper)**
**09:00–12:00**

**Calculators may be used.**

**This question paper consists of 6 pages.**

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

NATIONAL CERTIFICATE
LOGIC SYSTEMS N6
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. Write neatly and legibly.

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**NOTICE TO CANDIDATES**

The lives and safety of people depend on logic systems. Logic systems prevent lift doors from crushing persons to death. Logic signalling systems prevent trains from colliding. Logic systems keep people safe in aircraft and in hospital intensive-care units. Your work, programming and designs must be properly planned and presented at this Diploma-level examination. Standards must be maintained for the safety of the public.

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## QUESTION 1

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write 'true' or 'false' next to the question number (1.1–1.10) in the ANSWER BOOK and give a short explanation in support of each answer.

1.1 Declaration of variables within a Pascal program like String, Real and Integer prove the existence of data domains.

1.2 Intel Pentium microprocessors are examples of LSI (Large Scale Integration).

1.3 A modem is an interface.

1.4 A UART is an interface.

1.5 The weighted resistor digital-to-analogue converter uses an operational amplifier.

1.6 Bus use and tri-state devices are compatible.

1.7 A port can be described as an interface.

1.8 Stack use during an interrupt is completely different from stack use during a subroutine.

1.9 The American Standard Code for Information Interchange (ASCII) is used worldwide in IMB compatibles.

1.10 A bubble jet printer can be described as an interface.

(10 × 2) **[20]**

## QUESTION 2

2.1 Draw a neat, fully labelled block diagram of the successive approximation analogue-to-digital converter. (10)

2.2 Draw the working-process flow chart of the successive approximation analogue-to-digital converter. (9)

2.3 Show the binary counting process in the successive approximation analogue-to-digital converter to measure the input value of 8 V. (6)

**[25]**

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## QUESTION 3

3.1 Initially TWO types of microprocessor architecture were developed.

Concisely explain the major differences between Von Neumann computer architecture and Harvard computer architecture. (10)

3.2 Draw a fully labelled block diagram of an 8-bit or 16-bit Von Neumann architecture microprocessor. Name the manufacturer and identify the microprocessor by name or by model number. (10)
**[20]**

## QUESTION 4

4.1 Explain the term *machine cycle* of a digital computer by illustrating with a drawing how this can be presented on a timing diagram. (6)

4.2 4.2.1 Explain the purpose of the stack in a computer. (1)

4.2.2 Explain when and where the stack is used. (1)

4.2.3 Explain the operation of the stack when in use. (2)

4.3 PROGRAMMING INSTRUCTION PROCEDURE

The following instruction set is available:

| OP CODE | DESCRIPTION |
|---|---|
| LOAD | Load accumulator |
| ADDA | Add to accumulator |
| SUBT | Subtract from accumulator |
| MULT | Multiply |
| BRAN | Branch if the accumulator is negative |
| BRAP | Brings if the accumulator is positive |
| STOR | Store |
| OUTP | Output the contents of the accumulator |
| HALT | Halt (nonmemory referenced instruction) |

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Note the following specification information when writing the program:

- All mathematical operations done before coding must be shown.
- The first program address with which the program counter is loaded, is: CCCA (HEXADECIMAL).
- Case sensitivity: Operands must be lower case.
- Case sensitivity: Addresses must be upper case.
- You may NOT enlarge the instruction set.
- The program must stop processing if after any mathematical operation, the contents of the accumulator are positive. (NOTE: Positive)
- The correct delimiter must be used after delivering the output so that memory use is limited to program lines.

The operands r, s, t, u, v, w, x, y and z are stored in consecutive hexadecimal addresses:

Operand r is stored in address F1B1
Operand s is stored in address F1B2
Operand t is stored in address F1B3
Operand u is stored in address F1B4 – and so on.

The correct programming fields appear below:

| INSTRUCTION LOCATION | INSTRUCTION WORD | | DESCRIPTION |
|---|---|---|---|
| | OP CODE | ADDRESS | |
| | | | |

Use the correct programming fields to write a program to calculate the value of z if:

z = u(u+t) (10)
**[20]**

**QUESTION 5**

5.1 An electronic process control system is faulty. You as technician are tasked to locate and repair the fault. Within the circuitry is a non-inverting operational amplifier which is used to match impedances. All external connections are solid and correctly connected. Voltages are measured over the operational amplifier are as follows:

Supply: 24 volts
Input: 12 volts
Output: 6 volts

Explain and show exactly why it is necessary to replace the operational amplifier. (6)

5.2 Table and compare the advantages and disadvantages of the R/2R D/A converter with a weighted-resistor D/A converter. (6)

5.3 Explain briefly how the resolution of a D/A converter can be improved. (3)
**[15]**

**TOTAL: 100**

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