higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T960**(E)**(J30)T

NATIONAL CERTIFICATE

LOGIC SYSTEMS N6

(8080306)

31 July 2019 (X-Paper)
09:00–12:00

This question paper consists of 5 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

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. Keep subsections of questions together.
5. Write neatly and legibly.

NOTICE TO CANDIDATES

The lives and safety of people depend on logic systems. Logic systems prevent lift doors from crushing people 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. Safety standards must be maintained for the safety of the public and people at work.

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QUESTION 1

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

1.1 A flash converter is the fastest type of analogue-to-digital converter.

1.2 Intel Pentium microprocessors are examples of VLSI (very large-scale integration).

1.3 A modem is an interface.

1.4 A USART is an interface.

1.5 The R/2R digital-to-analogue converter uses an operational amplifier.

1.6 Bus use and tristate devices are compatible.

1.7 A USB port on a laptop computer 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 IBM compatibles.

1.10 A keyboard can be described as an interface.

(10 × 2) **[20]**

QUESTION 2

2.1 Draw a neat, fully labelled block diagram of a dual-slope integrating analogue-to-digital converter. (10)

2.2 Draw the working-process flowchart of a 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 4 V. Use 6 bits in the calculation. (6)

[25]

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QUESTION 3

3.1 Initially two types of microprocessor architecture were developed.

Name TWO types of computer architecture and explain the Von Neumann bottleneck as found in this type of architecture. (10)

3.2 Draw a fully labelled block diagram to illustrate the construction of a Harvard architecture scheme computer (NOT a microprocessor block diagram). (10)
[20]

QUESTION 4

4.1 Explain the term *machine cycle* regarding 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	Branch if the accumulator is positive
STOR	Store
OUTP	Output the contents of the accumulator
HALT	Halt (nonmemory-referenced instruction)

Note the following specification information when writing the program:

- Show ALL mathematical operations done before coding.
- The first program address with which the program counter is loaded is BCCA (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 content of the accumulator is negative (**NOTE:** negative).
- The correct delimiter must be used after delivering the output so that memory use is limited to program lines.

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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 x if:

$z = u^2 - t$ (10)
[20]

QUESTION 5

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

Supply: 15 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 Briefly explain how the resolution of a D/A converter can be improved. (3)
[15]

TOTAL: 100

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