higher education & training

Department:
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REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

LOGIS SYSTEMS N6

(8080306)

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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

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. Start each question on a new page.
5. 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 or aircraft from colliding in the air. Logic signalling systems prevent trains from colliding. Logic systems keep people safe in buildings and in hospital intensive-care units. Your work, programming and designs, must be properly planned and presented at this diploma exit-level examination. Standards must be maintained for the safety of the public.

QUESTION 1

Indicate whether the following statements are TRUE or FALSE by writing '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 EEPROM memories require external power to keep data when the computer is switched off.

1.2 Keyboards use a debouncing circuit on all the keys.

1.3 Machine language is classified as a high-level programming language.

1.4 A magnetic tape is labelled as a sequential access memory.

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

1.6 Bus use and tristate devices are compatible in a computer.

1.7 A USB port on your 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 no longer used in modern day IBM compatible computer systems.

1.10 A graph plotter can be described as an input peripheral device.

(10 × 2) **[20]**

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QUESTION 2

Most modern multimeters operate on the successive approximation method of analogue-to-digital conversion because conversion is much faster than the staircase ramp-type conversion used before.

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 to illustrate the operation of the successive approximation analogue-to-digital converter. (9)

2.3 Show the binary counting process for a 6-bit conversion in the successive approximation analogue-to-digital converter to measure the input value of 11 V. (6)

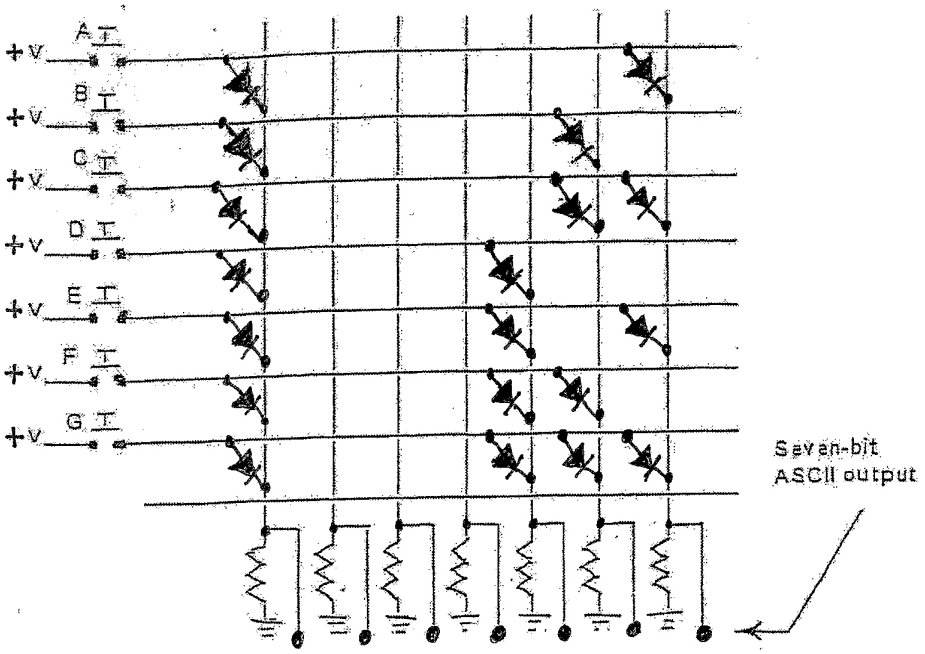
[25]

QUESTION 3

3.1 Initially two types of microprocessor architecture were developed by microprocessor manufacturers.

Explain the major differences between *Von Neumann computer architecture* and *Harvard computer architecture*. (10)

3.2 Refer to the diagram of a keyboard diode ROM, programmed to output the ASCII code for each particular key when pressed, as shown in the FIGURE below.



FIGURE

Draw a table to show both the binary and BCD values of the letters A to E as identified from the diodes programmed into the ROM. (10)

[20]

QUESTION 4

4.1 Explain the two terms, *D/A (digital-to-analogue) interfacing* and *A/D (analogue-to-digital) interfacing* in a computer control system for instrumentation. (6)

4.2 Explain the operation of the accumulator in a microcomputer when in use. (4)

4.3 PROGRAMMING INSTRUCTION PROCEDURE

The following instruction set is available:

OPCODE	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 and 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 FCCA (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.

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.

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The correct programming fields appear below:

INSTRUCTION LOCATION	INSTRUCTION WORD		DESCRIPTION
	OPCODE	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. As technician you were tasked to locate and repair the fault. Within the circuitry is an inverting operational amplifier which is used to amplify the output signal from a transducer. All external connections are solid and correctly connected. Voltages you measure over the operational amplifier are as follows:

Supply: +- 15 volts (dual voltage supply)
Input: -10 volts
Output: - 6 volts

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

5.2 Copy and complete the following TABLE in the ANSWER BOOK and state the advantages and disadvantages of the R/2R D/A converter.

ADVANTAGES	DISADVANTAGES

(6)

5.3 Briefly explain how the resolution of a D/A converter in an instrumentation system can be improved. (3)

[15]

TOTAL: 100

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