higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

LOGIC SYSTEMS N6

(8080306)

29 July 2021 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable 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

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully. Plan your answer and then start to answer the question.
3. Number the answers according to the numbering system used in this question paper.
4. Start each question on a new page.
5. Only use a black or blue pen.
6. Write neatly and legibly.

NOTICE TO CANDIDATES

The lives and safety of people depend on logic systems. Logic systems form an integral part of intrinsic safety in equipment. 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 and safe operation of machinery.

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QUESTION 1

1.1 Computers make use of both static and dynamic RAM memory.

Make neat sketches to illustrate the differences in the construction of these TWO types of MOS memory cells. (2 × 5) (10)

1.2 Modern technology has largely replaced hard-wired and analogue instrumentation systems with digital systems.

List FIVE advantages of using a digital system with modern technology. (5 × 2) (10)

[20]

QUESTION 2

Indicate whether the following statements are TRUE or FALSE. Answer the questions in numerical order. Write 'True' or 'False' in capital letters next to the question number (2.1–2.10) in the ANSWER BOOK. Give a short explanation in support of each of your answers.

2.1 The instruction register holds the data stored in the current instruction.

2.2 The program counter stores a count of all the data stored in RAM.

2.3 A solid-state drive has faster access time than a conventional hard disk drive.

2.4 Both static and dynamic RAM needs to be refreshed constantly.

2.5 Cloud storage can only store a limited amount of data.

2.6 A server can offer huge storage capacity but has small memory capacity.

2.7 Daisy chain interfacing of disk drives uses more hardware than radial interfacing.

2.8 RS-232 type serial ports are much faster than Universal Serial Bus (USB) interfacing.

2.9 The Harvard architecture computer system makes use of two separate memories.

2.10 A printer can be classified as an input peripheral device and a keyboard as an output peripheral device.

(10 × 2) **[20]**

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QUESTION 3

3.1 Describe the use of compiler software in your computer. (4)

3.2 Most computers use a bus structure or system to link the various components within the system.

Name the THREE different types of busses and make a sketch clearly showing the connections and directions of these three busses in a simple computer system. (8)

3.3 You are a resident electronics engineer. You have to draw up a design concept to replace an obsolete operational amplifier control system with a modern digital computer control system. The system must control the level of sunflower oil in a stainless-steel tank.

You must do the following:

- Draw a large, neat, fully labelled block diagram showing the interfacing of the input/output ports of the computer used to monitor and control the oil level in the tank.
- The labels must appear on the block diagram itself.
- Clearly show the configuration of each input/output port.
- Show all interfacing
- and process functions needed to monitor and control the oil level.
- Show signal directions.
- Show the interfacing of sensor(s) and actuator(s).
- Label the feedback and action loops clearly. (8)

[20]

QUESTION 4

4.1 Neatly draw a complete keyboard diode matrix circuit diagram so that striking each of the keys from A to F (NOTE: capital letters) will produce the correct ASCII equivalent. Do not include a parity bit output.

NOTE: A = 41 BCD. (8)

4.2 Draw a neat sketch to illustrate what contact bounce will look like on an oscilloscope and describe the advantage of adding a de-bounce function to the keypad. (4)

4.3 The flash converter can instantly produce a digital output of the analogue voltage applied to it.

Draw a complete, labelled block diagram of a 3-bit parallel ADC (flash converter) and the decoding table for this converter. (8)

[20]

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QUESTION 5

5.1 PROGRAMMING INSTRUCTION PROCEDURE

The following instruction set for a specific micro-processor is listed:

OP-CODE	DESCRIPTION
LOAD	Load into accumulator
ADDA	Add to accumulator
SUBT	Subtract from accumulator
MULT	Multiply
DIV	Divide
BRAN	Branch if the accumulator is negative
BRAP	Branch if the accumulator is positive
STOR	Store
OUTP	Output the contents of the accumulator
HALT	Stop processing (non-memory referenced instruction)

Note the following specification information when writing the program:

- All mathematical operations done before coding must be shown
- The program counter is loaded with EBAA (Hexadecimal) to begin the program
- 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 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
	OP-CODE	ADDRESS	

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

$$r = us + ux + uy$$

You may simplify the equation before writing your program. (10)

5.2 List and identify the use of FIVE well-known open-source software packages. (5 × 2) (10)

[20]

TOTAL:

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