higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

LOGIC SYSTEMS N6

(8080306)

18 November 2022 (X-paper)
09:00–12:00

Drawing instruments may be used.

This question paper consists of 6 pages.

090Q1E2218

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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. Use only a black or a blue pen.
6. Write neatly and legibly.

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QUESTION 1

1. 1 Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–U) next to the question number (1.1.1–1.1.15) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1.1	This binary code is used in data transmission from keyboard to computer	A	disk drive
1.1.2	This device has movable read/write heads	B	EPROM
1.1.3	This device acts as interface between the land line and computer	C	BASIC
1.1.4	These memory chips (IC's) can be re-programmed.	D	analogue
1.1.5	This is an output peripheral device	E	digital
1.1.6	LOAD, MULT, SUBT, are all examples of programming instructions in this programming language	F	Schmitt-Trigger
1.1.7	Cell phones use this form of technology	G	ASCII
1.1.8	This circuit can change a sine wave input to a square wave output	H	modem
1.1.9	In this configuration an Op amp cannot have a gain of less than one	I	printer
1.1.10	This type of memory requires constant refreshing	J	keyboard
1.1.11	This function prevents multiple micro-closures of keyboard switch contacts	K	assembler
1.1.12	In this type of multiple disk drive interfacing, each drive is buffered	L	Inverting Op-Amp
1.1.13	Error if the output of a D/A converter is not zero if the input is zero	M	non-inverting
1.1.4	Register holding instructions during the execution of a program	N	de-bounce
1.1.15	The comparison between the actual and required output of a digital to analogue converter	O	radial
		P	daisy- chain
		Q	offset error
		R	instruction register
		S	accuracy
		T	Dynamic RAM
		U	Static RAM

(15 × 1) (15)

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1.2 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (1.2.1–1.2.5) in the ANSWER BOOK. Give ONE reason for each answer.

1.2.1 The Instruction Register holds both the OP-code and the operand address of the current instruction.

1.2.2 The Program Counter stores a count of all the programs stored in RAM.

1.2.3 Computer operations are synchronized with the 50 Hz from the power station.

1.2.4 Cell phone switching is accomplished by relay-logic.

1.2.5 The bus is the interface between the computer and an output peripheral device such as a printer. (5 × 2) (10)

[25]

QUESTION 2

Explain the following terms with reference to a D/A converter.

2.1 Resolution

2.2 Accuracy

2.3 Output settling time

2.4 Monotonicity

2.5 Offset error

(5 × 2) **[10]**

QUESTION 3

3.1 Explain each of the following terms in detail with reference to the micro-processor.

3.1.1 Data bus

3.1.2 Address bus

3.1.3 Control bus

3.1.4 Control unit

3.1.5 Machine language

(5 × 3) (15)

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3.2 Micro-processors allow for two types of interrupts, namely hardware interrupts and software interrupts.

Provide a detailed explanation of the difference in operation between these two types of interrupts. (2 × 5) (10)
[25]

QUESTION 4

4.1 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 (non-memory 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: CCAA (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 is 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 y if: (10)

$x = u^2 - ut$

4.2 Draw the block diagram of an operational amplifier connected in circuit as a voltage comparator to a fixed reference voltage. Also show the output signal for a varying input voltage below and above the reference voltage. (10)
[20]

QUESTION 5

5.1 The range of the R/2R D/A converter can be easily extended by only adding another R and 2R resistor to the input.

Design and draw the circuit of such a converter using 4 inputs. Label and indicate the position of the R and 2R resistors in the ladder network of this circuit. (10)

5.2 The measurement of a dual-slope analogue-to-digital converter (ADC) is done on the principle of comparing two integrations made over a fixed integrating time constant.

Design and draw a neat and labelled block diagram of such a converter. Also draw the integration outputs from this converter. (10)
[20]

TOTAL: 100

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