higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T820**(E)**(N25)T
NOVEMBER EXAMINATION

NATIONAL CERTIFICATE

LOGIC SYSTEMS N5

(8080295)

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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 N5
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. All circuits must be fully labelled.
5. Binary registers should be drawn with the most significant bit (MSB) flip-flop on the left and the least significant bit (LSB) flip-flop on the right.
6. Waveforms should be drawn with the clock input at the top followed by the LSB flip-flop output below the clock input and with the MSB flip-flop output as the last output waveform at the bottom.
7. Write neatly and legibly.

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QUESTION 1

A machine X requires a binary counter which counts as follows:

0000_2, 0001_2, 0010_2, 0011_2, 0100_2, 0101_2, 0110_2, 0111_2 and 1000_2

Design a synchronous binary counter that produces the above count cycle. The counter must be self-starting and must exit from any unused state to the starting state within ONE clock pulse.

Design and draw the circuit and make use of JK master/slave flip-flops. **[15]**

QUESTION 2

A machine Y requires a binary counter which counts as follows:

0000_2, 0001_2, 0010_2, 0011_2, 0100_2, 0101_2, 0110_2, 0111_2 and 1000_2

Draw the truth table, circuit and the input and output waveforms for an asynchronous counter which uses a gated reset/set to produce the above count cycle.

Use JK master/slave flip-flops in the circuit.

The truth table and waveforms must clearly show the reset action. **[15]**

QUESTION 3

3.1 You are required to convert a 400 MHz frequency clock-pulse series to a 50 MHz clock-pulse series.

Draw a fully labelled suitable circuit which uses JK master/slave flip-flops that will achieve this. Indicate on the circuit the input frequency, ALL the output frequencies and ALL the logic levels at ALL the control inputs of the flip-flops.

3.2 Calculate or motivate the number of JK flip-flops that are required in QUESTION 3.1.

(2 x 5) **[10]**

QUESTION 4

A multiplexer is typically used to convert parallel binary data to series data.

Draw a fully labelled multiplexer circuit that converts 4 data bits to series data. Your circuit must include the complete ring counter circuit that sequences the parallel data bits onto the single transmission line. **[15]**

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QUESTION 5

Arithmetic Logic Units (ALUs) perform the arithmetic operations in a computer.

Draw a fully labelled circuit diagram of a 4-bit binary adder/subtractor which uses the 2's complement method of subtraction. Indicate on the circuit ALL the logic 1's and logic 0's if the circuit has to perform 12 minus 6. **[15]**

QUESTION 6

6.1 Explain the purpose of the internal memory such as SRAM, DRAM and hard disk storage. (5)

6.2 Choose a description from COLUMN B that matches the type of memory in COLUMN A. Write only the letter (A–J) next to the question number (6.2.1–6.2.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
6.2.1	RAM	A	utilise(s) semiconductors
6.2.2	SRAM	B	an early form of secondary computer memory
6.2.3	DRAM	C	has/have hysteresis effect
6.2.4	ROM	D	random access memory
6.2.5	Magnetic core memory	E	a rotating disk-type memory
6.2.6	DRAM and SRAM memories	F	do/does not require refresh circuitry
6.2.7	Magnetic drum memory	G	sequential access-type memory
6.2.8	MOS memory	H	used to permanently store fixed data
6.2.9	Magnetic disk memory	I	require(s) refresh circuitry
6.2.10	Magnetic tape memory	J	store(s) data in the form of electrostatic charge

(10 × 1) (10)
[15]

QUESTION 7

Complete the following sentences by only writing the missing word next to the question number (7.1–7.15) in the ANSWER BOOK.

A **dot matrix printer** or **impact matrix printer** is a type of computer printer with a (7.1) ... head that runs back and forth or in an up and down motion on the page.

It prints by (7.2) ... striking an ink-soaked cloth ribbon against the (7.3) ..., much like the print mechanism of a typewriter.

Unlike a typewriter or daisy wheel printer, letters are drawn out of a dot (7.4) ... and thus varied fonts and arbitrary graphics can be produced. Because printing involves mechanical pressure, these printers can create carbon copies and carbonless copies.

Each dot is produced by a tiny metal (7.5) ..., also called a 'wire' or 'pin'. It is driven by the power of a tiny (7.6) ... or solenoid, either directly or through small levers (pawls).

In a typical **drum printer** design, a fixed font (7.7) ... set is engraved onto several radial tracks along the length of a large drum (cylinder), which (7.8) ... at high speed and paper and an inked ribbon are stepped (moved) past the print position. As the desired (7.9) ... for each column passes the print position, a (7.10) ... strikes the paper from the rear and (7.11) ... the paper against the ribbon and the drum, causing the desired (7.12) ... to be recorded on the continuous paper.

Chain printers (also known as **train printers**) placed the words on moving bars, a horizontally-moving (7.13) ... As with the drum printer, a (7.14) ... would strike from behind the paper as the correct (7.15) ... passed each column. (15 x 1) **[15]**

TOTAL: 100

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