higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

LOGIC SYSTEMS N5

(8080295)

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

Drawing instruments may be used.

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. Label all circuits fully.
5. Draw binary registers with the Most Significant Bit (MSB) flip flop on the left and the Least Significant Bit (LSB) flip flop on the right.
6. Draw waveforms with the clock input on top, followed by the LSB flip flop output below the clock input, and 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 crane safety circuit requires a binary counter which counts as follows:

011_2, 100_2, 101_2, and 110_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 by making use of JK master/slave flip-flops. **[15]**

QUESTION 2

A factory component counter needs to generate the following count cycle:

001_2, 010_2, 011_2, 100_2, 101_2, and 110_2.

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

Use JK master/slave flips in the circuit.

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

QUESTION 3

3.1 The measurement of a signal's frequency is simply the counting of the signal's pulses for a fixed, accurate period of time, usually one second.

Draw a fully labelled block diagram of a typical frequency counter. (7)

3.2 Draw a typical set of waveforms for the frequency counter in QUESTION 3.1 above. (5)

[12]

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QUESTION 4

T	8	4	2	1
0	1	1	1	1
1	0	1	1	1
2	0	0	1	1
3	0	0	0	1
4	0	0	0	0
5	1	0	0	0
6	1	1	0	0

FIGURE 4.1

T	8	4	2	1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	1
3	0	1	1	1
4	1	1	1	1
5	1	1	1	0
6	1	1	0	0

FIGURE 4.2

T	8	4	2	1
0	0	0	0	1
1	0	0	1	0
2	0	1	0	0
3	1	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0

FIGURE 4.3

T	8	4	2	1
0	1	0	0	0
1	0	1	0	0
2	0	0	1	0
3	0	0	0	1
4	1	0	0	0
5	0	1	0	0
6	0	0	1	0

FIGURE 4.4

T	8	4	2	1
0	0	0	0	1
1	0	0	1	0
2	0	1	0	0
3	1	0	0	0
4	0	0	0	1
5	0	0	1	0
6	0	1	0	0

FIGURE 4.5

4.1 Identify the circuit which generates the truth table in FIGURE 4.1. (1)

4.2 Identify the circuit which generates the truth table in FIGURE 4.2. (1)

4.3 Identify the circuit which generates the truth table in FIGURE 4.3. (1)

4.4 Identify the circuit which generates the truth table in FIGURE 4.4. (1)

4.5 Identify the circuit which generates the truth table in FIGURE 4.5. (1)

4.6 What will the number be at clock pulse 9, 10 and 11 in the truth table represented by FIGURE 4.4? (3)

4.7 Draw the waveforms for the truth table represented in FIGURE 4.4. (5)

[13]

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 by applying the 2's compliment method of subtraction. On the circuit, indicate all the logic 1's and logic 0's if the circuit has to perform 12 minus 6. **[15]**

QUESTION 6

6.1 Describe the difference between a ROM and a RAM. (4)

6.2 Why are RAMs and ROMs required in personal computers? (3)

6.3 Describe briefly what a CD ROM is. (3)

6.4 What is the purpose of a DVD in a personal computer? (3)

6.5 What is the meaning of the acronym EEPROM? (2)

[15]

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QUESTION 7

Complete the following sentences by filling in the missing word in each sentence. Write only the missing word next to the question number (7.1–7.15) in your ANSWER BOOK.

In a typical drum printer design, a fixed font (7.1) … set is engraved onto several radial tracks along the length of a large drum (cylinder), which (7.2) … at high speed. Paper and an inked ribbon are stepped (moved) past the print position. As the desired character for each column passes the print position, a (7.3) … strikes the paper from the rear and (7.4) … the paper against the ribbon and the drum, causing the desired (7.5) … to be recorded on the continuous paper.
A dot matrix printer or impact matrix printer is a type of computer printer with a (7.6) … head that runs back and forth or up and down on the page and prints by (7.7) … an ink-soaked cloth ribbon against the (7.8) …, much like the print mechanism on a typewriter. But unlike a typewriter or daisy wheel printer, letters are drawn out of a dot (7.9) … and thus varied fonts and arbitrary graphics can be produced. Because the printing involves mechanical (7.10) …, these printers can create both carbon copies and carbonless copies.
Each dot is produced by a tiny metal (7.11) …, also called a "wire" or "pin", which is driven forward by the power of a tiny (7.12) … or solenoid, either directly or through small levers (pawls).
Chain printers (also known as train printers) place the type on moving bars (a horizontally-moving (7.13) … . As with the drum printer, as the correct (7.14) … passed by each column, a (7.15) … is fired from behind the paper. **[15]**

TOTAL: 100

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