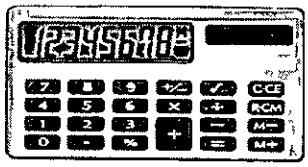
UNIVERSITY EXAMINATIONS



UNIVERSITEITSEKSAMENS

UNISA university of south africa

DIG1501

May/June 2014

DIGITAL SYSTEMS I (THEORY)

Duration 3 Hours

100 Marks

EXAMINERS
FIRST MR PO UMENNE
SECOND MR NR NETSHIKWETA

Programmable pocket calculator is permissible

Closed book examination

This examination question paper remains the property of the University of South Africa and may not be removed from the examination venue

This examination question paper consists of 5 pages including the cover page

Answer all the questions

PLEASE NOTE: IF YOU HAVE THE OPINION THAT INSUFFICIENT INFORMATION IS SUPPLIED FOR YOU TO ANSWER A PARTICULAR QUESTION, MAKE A REALISTIC ASSUMPTION, MOTIVATE IT AND THEN ANSWER THE QUESTION.

QUESTION 1 NUMBER SYSTEMS OPERATIONS AND CODES

1 1 Express the decimal number -34 in the 2's complement form of a binary number (3)

1 2 In the 2's complement form, the binary number 10010011 is equal to which decimal number? (3)

1 3 The binary number for $F7A9_{16}$ is? (3)

1 4 The BCD number for decimal 473 is? (3)

1 5 Divide 01000100 by 00011001 (3)

[15]

QUESTION 2 LOGIC GATES

2 1 Determine the output waveform in figure 1 below (5)

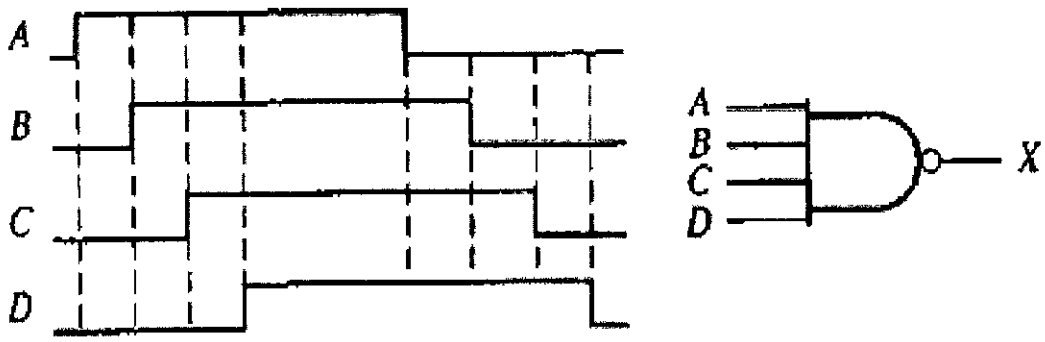


Figure 1 waveform

2 2 Design a circuit that will cause the headlights of an automobile to be turned off automatically 15secs after the ignition switch is turned off, if the light switch is left on Assume that a LOW is required to turn the lights off

Show a truth table, an equation, and a circuit diagram (10)

[15]

QUESTION 3 BOOLEAN ALGEBRA AND LOGIC SIMPLIFICATION

3 1 Apply DeMorgan's theorems to the following expression (4)

$\left(A + \overline{B\bar{C}} + CD\right) + \overline{\overline{BC}}$

3 2 Using Boolean algebra, simplify the following expression

$\bar{A}\bar{B}C + \left(\overline{A + B + \bar{C}}\right) + \bar{A}\bar{B}\bar{C}D$ (4)

3 3 Convert the following expression to the standard sum-of-product (SOP) form

$(A + C)(AB + AC)$ (4)

[12]

QUESTION 4 KARNAUGH MAP

4 1 Expand the following expression to the standard SOP form (9)

$A\bar{B} - A\bar{B}\bar{C}D + CD + B\bar{C}D + ABCD$

4 2 Minimize the expanded expression above with a Karnaugh map (6)

[15]

QUESTION 5 COMBINATIONAL LOGIC ANALYSIS

5 1 Implement the expression below using only NAND gates Sketch the circuit diagram (10)

$X = (A + B)(C + D)$

5 2 For the input waveforms in figure 2 below, what logic circuit will generate the output waveform shown in the same figure?

5 2 1 Generate a truth table (4)

5 2 2 Write the SOP expression (3)

5 2 3 Sketch the logic circuit (3)

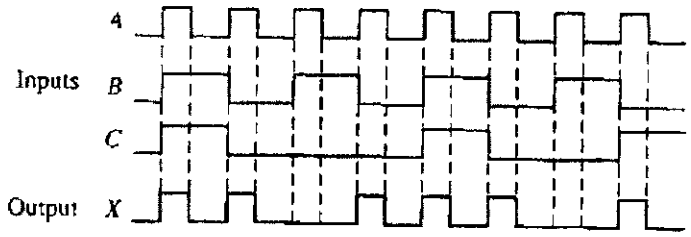


Figure 2 waveform

[20]

QUESTION 6 FUNCTIONS OF COMBINATIONAL LOGIC

The waveforms in figure 3 below are observed in the inputs of a 74LS151 8-input multiplexer Sketch the Y output

6 1 Develop the truth table first (6)

6 2 Sketch the waveform of the Y-output (6)

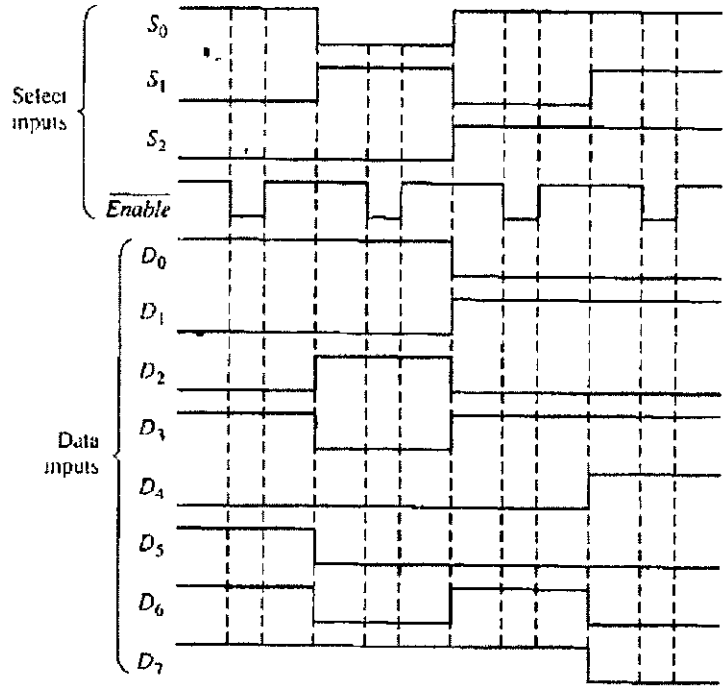


Figure 3

[12]

QUESTION 7 FUNCTIONS OF COMBINATIONAL LOGIC

7 1 For the parallel adder in figure 4, determine the complete sum by analysis of the logical operation of the circuit (6)

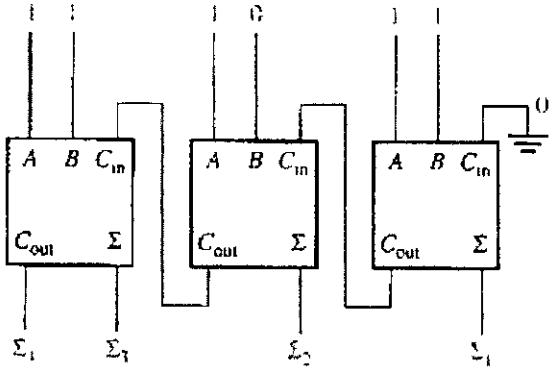


Figure 4

7 2 The waveforms in figure 5 are applied to the comparator as shown Determine the output (A=B) waveform (5)

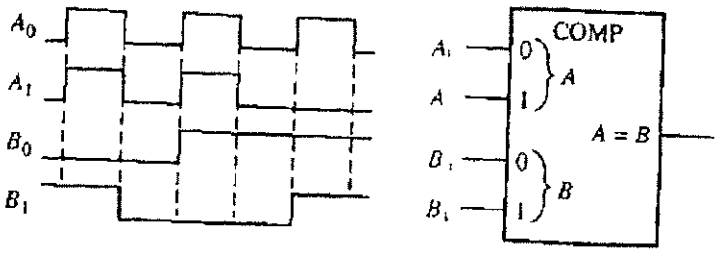


Figure 5

[11]

Total: 100

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