Philadelphia University
Faculty of Engineering

Marking Scheme

Exam Paper

BSc CE

Logic Circuits (630211)

First Exam First semester Date: 21/11/2019

Section 1

Weighting 20% of the module total

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Marking Scheme

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The presented exam questions are organized to overcome course material through 4 questions.
The *all questions* are compulsory requested to be answered.

Marking Assignments

Question 1 This question is attributed with 6 marks if answered properly; the answers are as following:

1) The **binary** number for $\mathbf{F7A9_{16}}$ is

a) **1110111110101001** **b)** **1111111010110001**
c) **1111011110101001** **d)** **1111011010101001**

2) When signed numbers are used in binary arithmetic, then which one of the following notations would have **unique** representation for **zero**?

a) **Sign-magnitude** **b)** **9's complement**
c) **1's complement** **d)** **2's complement**

3) The **signed magnitude** number $\mathbf{11001100_2}$ is equivalent to

a) $\mathbf{-76_{10}}$ **b)** $\mathbf{204_{10}}$
c) $\mathbf{CC_{16}}$ **d)** $\mathbf{1212_{10}}$

4) The **octal** equivalent of the number $\mathbf{(700)_{16}}$ is:

a) **1000** **b)** **3400**
c) **700** **d)** **7000**

5) The **octal** number represented by the **binary** number $\mathbf{110111011.101_2}$ is

a) **673.5** **b)** **31311.21**
c) **1BB** **d)** **none of the above**

6) In the **sum of products** functions $\mathbf{f(X,Y,Z)} = \sum(\mathbf{2,3,4,5})$, the **prime implicants** are

a) $\bar{X}Y, X\bar{Y}$
b) $\bar{X}Y, X\bar{Y}\bar{Z}, X\bar{Y}Z$
c) $\bar{X}Y\bar{Z}, \bar{X}YZ, X\bar{Y}$
d) $\bar{X}Y\bar{Z}, \bar{X}YZ, X\bar{Y}\bar{Z}, X\bar{Y}Z$

Question 2 This question is attributed with 5 marks if answered properly; the answers are as following:

a) ***(2 marks)***

Solution

$$
\begin{aligned}
f &= AB + A\bar{C} + C + AD + A\bar{B}C + ABC \\
&= AB + A\bar{C} + C + AD + AC\,(B + \bar{B}) \\
&= AB + A\bar{C} + C + AD + AC \\
&= AB + C + AD + A\,(C + \bar{C}) \\
&= AB + A + AD + C \\
&= A\,(1 + B) + AD + C \\
&= A + AD + C \\
&= A\,(1 + D) + C \\
&= A + C
\end{aligned}
$$

b) ***(3 marks)***

Solution

Solution

The expression for the output of the circuit is

$$X = (\overline{\overline{A}\,\overline{B}\,\overline{C}})C + \overline{\overline{A}\,\overline{B}\,\overline{C}} + D$$

Applying DeMorgan's theorem and Boolean algebra

$$
\begin{aligned}
X &= (\bar{\bar{A}} + \bar{\bar{B}} + \bar{\bar{C}})C + \bar{\bar{A}} + \bar{\bar{B}} + \bar{\bar{C}} + D \\
&= AC + BC + CC + A + B + C + D \\
&= AC + BC + C + A + B + C + D \\
&= C(A + B + 1) + A + B + D \\
X &= A + B + C + D
\end{aligned}
$$

Question 3 This question is attributed with 5 marks if answered properly; the answers are as following:

a) ***(3 marks)***

Solution

product of maxterms

$$\begin{aligned} D &= (\overline{A}+B)(C+\overline{C})(\overline{B}+C)(A+\overline{A}) \\ &= (A+\overline{B}+C)(\overline{A}+B+C)(\overline{A}+B+\overline{C})(\overline{A}+\overline{B}+C) \\ &= M_2 \cdot M_4 \cdot M_5 \cdot M_6 = \Pi(2,4,5,6) \end{aligned}$$

sum of minterms

$$D = \Sigma(0,1,3,7) = m_0 + m_1 + m_3 + m_7 = \overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}C + \overline{A}BC + ABC$$

b) ***(2 marks)***

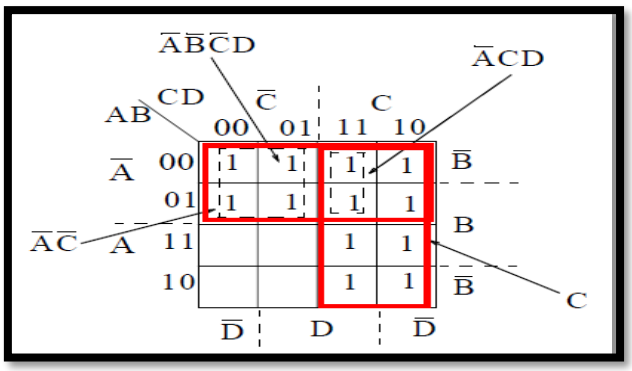
Solution

$f(w, x, y, z) = wx + xz + y$

w	x	y	z	Output= $wx + xz + \overline{y}$
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

Question 4 This question is attributed with 4 marks if answered properly; the answers are as following:

Solution



$$E = \overline{A} + C$$