

Digital Logic

CS207 Assignment 2: Theory (Part 1)

补充说明

Assignment is pledged that you have neither given nor received unauthorized help. All course work should be completed entirely on your own. Students who commit an act of academic dishonesty may receive a zero on the assignment or in the course.

Due on 23:55, Nov. 1, 2022

Assignment Notes



- ▶ Write neatly on A4 papers and submit an e-copy to Sakai on time.
- ▶ Do write down all procedures. Only presenting the final answer will lead to a zero, even the answer is correct.
- ▶ Do double-check your submitted file. No re-submission is allowed for student reasons, e.g., corrupted file uploaded.
- ▶ Box answers when applicable.
- ▶ Draw logic diagrams with a pen or any software applicable.
- ▶ Turn assignments in early if possible.
- ▶ Part 1 of this assignment accounts for 60%, Part 2 the remaining 40%.
- ▶ Request to regrade will lead to a complete regrade on all questions in the assignment. Final grades may increase or decrease.



Question 1

- ▶ (10 points) Design a four-bit 2's complementer with only OR and XOR gates. Draw the logic diagram.

补充说明：需要写出真值表。每个输出的表达式需要化简。

电路限定用异或和或门，可以用反相器。逻辑电路图需要标注输入/输出。



Question 2

- ▶ (20 points) Design a combinational circuit with three inputs, x , y , and z , and three outputs, A , B , and C . When the binary input is 0, 1, or 2, the binary output is two greater than the input. When the binary input is 3, 4, 5, 6, or 7, the binary output is one less than the input. Draw the logic diagram.

补充说明：输入从最高位到最低位是 x, y, z ；输出从最高位到最低位是 A, B, C 。

需要写出真值表。每个输出的表达式需要化简（但不一定是最简）。

电路没有限定门电路类型，但必须是组合电路。逻辑电路图需要标注输入/输出。

不能对于每个输出单独画一个完全独立的电路，需要是一个电路整体。



Question 3

- ▶ (20 points) A combinational circuit has four inputs A , B , C , and D , and one output Z . The output is 0 if the input combination is a valid BCD coded decimal digit. Otherwise, the output is 1. Draw the logic diagram.

补充说明：从最高位到最低位是 A , B , C , D ，输出为 Z 。

需要写出真值表。每个输出的表达式需要化简。

电路没有限定门电路类型，但必须是组合电路。逻辑电路图需要标注输入/输出。

不能对于每个输出单独画一个完全独立的电路，需要是一个电路整体。



Question 4

- (20 points) An 8-to-1 MUX has inputs A , B , and C connected to selection lines S_2 , S_1 , and S_0 , respectively. The data inputs I_0 to I_7 are connected as $I_1 = I_2 = I_7 = 1$, $I_3 = I_5 = 0$, $I_0 = I_4 = D$, and $I_6 = D'$. Determine the Boolean expression of the MUX output.

补充说明：从最高位到最低位是 A , B , C ，分别连接 S_2 , S_1 , S_0 。
输出的表达式需要化简。



Question 5

- (20 points) Implement the Boolean function $F(A, B, C, D) = \sum(1, 2, 4, 9, 12, 13, 15)$ using
1. decoder and external gates, and
 2. 8-to-1 MUX and external gates.

Draw the logic diagram.

补充说明: Decoder使用74154, 需要标74154的输入和输出引脚。
8-to-1 MUX需要标输入和输出引脚, 需要解题过程。



Question 6

- ▶ (10 points) Using decoders and external gates, design and draw three combinational circuits defined by the following three Boolean functions:

$$F_1 = x'y'z' + xz, F_2 = xy'z' + x'y, F_3 = x'y'z' + xy.$$

补充说明: Decoder使用74154, 需要标74154的输入和输出引脚。需要解题过程。

74138, not 74154

Don't forget that this assignment has a

Part 2: Digital Logic Lab

to complete!