**ENGG1100 Introduction to Engineering Design**

**Faculty of Engineering, The Chinese University of Hong Kong**

**Digital Logic (2)**

**Laboratory Record and Report Sheet 6**

Group No: \_\_\_\_\_\_\_\_\_\_\_\_, Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student 1:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(SID)\_\_\_\_\_\_\_\_\_\_\_\_\_ ; Student 2:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(SID)\_\_\_\_\_\_\_\_\_\_\_\_\_

***After your group has completed this lab work, demonstrate your results to the tutor and ask the tutor (TA) to sign below.* Submit this sheet to the tutor within one week after this laboratory session finishes.**

Name of the tutor/ signature of the tutor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ /\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Experiment 1: The Smart-car control logic by the truth table approach***

**Procedures:**

1. Connect the DC 9V power to the Smart-car board (no need to connect the Serial COM cable) , then turn on the power supply and turn on the power switch on the board.
2. Start to examine the different input combinations of S4 (LED4), S3 (LED3), S2 (LED2) and S1 (LED1) by pressing the corresponding push buttons as shown in the Figure 1 (see the lab manual), and record the outputs of LM1 (LED7), LM2 (LED8), RM1 (LED9) and RM2 (LED10).

**NOTICE:**

*When you release Si (i=1 or 2 or 3 or 4), it will be at logic level* ***‘1’*** *the corresponding LED is* ***off****.*

*When you press Si (i=1 or 2 or 3 or 4), it will be at logic level* ***‘0’*** *the corresponding LED is* ***on****.*

*When LM1(or LM2, RM1, RM2) is at logic level* ***‘0’*** *the corresponding LED7(or LED8, LED9, LED10) is* ***off****.*

*When LM1(or LM2, RM1, RM2) is at logic level* ***‘1’*** *the corresponding LED7(or LED8, LED9, LED10) is* ***on****.*

1. Record the outputs in the following table, and verify that if the outputs agree with the logic functions in the program segment (see Program\_segment1 in the lab manual).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Inputs** | | | | **Outputs** | | | |
| **S4** | **S3** | **S2** | **S1** | **LM1** | **LM2** | **RM1** | **RM2** |
| 0 | 0 | 0 | 0 |  |  |  |  |
| 0 | 0 | 0 | 1 |  |  |  |  |
| 0 | 0 | 1 | 0 |  |  |  |  |
| 0 | 0 | 1 | 1 |  |  |  |  |
| 0 | 1 | 0 | 0 |  |  |  |  |
| 0 | 1 | 0 | 1 |  |  |  |  |
| 0 | 1 | 1 | 0 |  |  |  |  |
| 0 | 1 | 1 | 1 |  |  |  |  |
| 1 | 0 | 0 | 0 |  |  |  |  |
| 1 | 0 | 0 | 1 |  |  |  |  |
| 1 | 0 | 1 | 0 |  |  |  |  |
| 1 | 0 | 1 | 1 |  |  |  |  |
| 1 | 1 | 0 | 0 |  |  |  |  |
| 1 | 1 | 0 | 1 |  |  |  |  |
| 1 | 1 | 1 | 0 |  |  |  |  |
| 1 | 1 | 1 | 1 |  |  |  |  |

Table 1: Truth Table of Smart-car control logic

4. Is the relation between the input and the output agree with the program segment?

***Experiment 2: The operations of a simple state machine***

**Procedures:**

1. Connect input S5 to Ground (GND) by using the DuPont wire.
2. Connect the DC 9V power to Smart-car board (no need to connect the Serial COM cable), then turn on the power supply and turn on the power switch on the board.
3. Record the outputs in the table below.
4. Explain the outputs based on **program\_segment2** (see the lab manual).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Time**  **(seconds)** | **LED Outputs** | | | |
| **LM1** | **LM2** | **RM1** | **RM2** |
| Reset |  |  |  |  |
| 2 |  |  |  |  |
| 4 |  |  |  |  |
| 6 |  |  |  |  |
| 8 |  |  |  |  |
| 10 |  |  |  |  |
| 12 |  |  |  |  |
| 14 |  |  |  |  |

Table 2: Function table of state machine without sensor inputs

\*LED = Light Emitting Diode

***Experiment 3: The state diagram of a state machine with sensor inputs***

**Procedures:**

1. Connect inputs S6 to Ground (GND) by using the DuPont wires.
2. Connect the DC 9V power to the Smart-car board (no need to connect the Serial COM cable), then turn on the power supply and turn on the power switch on the board.
3. Press the Reset button and start to record the outputs. (Press Reset button to re-start the system and the program)
4. Fill in the table below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Inputs** | | | **LED Outputs** | | | |
| **S3** | **S2** | **S1** | **LM1** | **LM2** | **RM1** | **RM2** |
| 0 | 0 | 0 |  |  |  |  |
| 0 | 0 | 1 |  |  |  |  |
| 0 | 1 | 0 |  |  |  |  |
| 0 | 1 | 1 |  |  |  |  |
| 1 | 0 | 0 |  |  |  |  |
| 1 | 0 | 1 |  |  |  |  |
| 1 | 1 | 0 |  |  |  |  |
| 1 | 1 | 1 |  |  |  |  |

Table 3: Function table of the state machine with sensor inputs

***Conclusion: write 100 words to discuss what you have learned from this lab. Add extra sheets if necessary.***

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