**ENGG1100 Introduction to Engineering Design**

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

**Laboratory 5: Digital Logic (1)**

**Laboratory Record Sheet (Report sheet)**

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: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ /\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Part I: Simple logic functions AND OR***

**Written exercise 1.1: Fill in the truth table of *AND* logic function. (No hardware experiment is required for this exercise)**

|  |  |  |
| --- | --- | --- |
| pic015Inputs | | Output |
| A | B | Q |
| 0 | 0 |  |
| 0 | 1 |  |
| 1  AND logic | 0 |  |
| 1 | 1 |  |

**Written exercise 1.2: Fill in the truth table of *OR* logic function. (No hardware experiment is required for this exercise)**

|  |  |  |
| --- | --- | --- |
| pic016Inputs | | Output |
| A | B | Q |
| 0 | 0 |  |
| 0 | 1 |  |
| 1  OR logic | 0 |  |
| 1 | 1 |  |

**Experiment 1.3: Fill in the truth table of *AND* logic function by experiment. (Hardware experiment is required for this and the following exercises)**

***LEDi can be “ON “ or “OFF; Outi can be ‘0’ or ‘1’***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Inputs** | | | | **Outputs Q** | |
| S3 | S1 | LED3 | LED1 | LED7 | Out1 |
| 0 | 0 | ON | ON |  |  |
| 0 | 1 | ON | OFF |  |  |
| 1 | 0 | OFF | ON |  |  |
| 1 | 1 | OFF | OFF |  |  |

**Experiment 1.4: Fill in the truth table of *OR* logic function by experiment. (Hardware experiment is required for this and the following exercises)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Inputs** | | | | **Outputs Q** | |
| S3 | S1 | LED3 | LED1 | LED9 | Out3 |
| 0 | 0 | ON | ON |  |  |
| 0 | 1 | ON | OFF |  |  |
| 1 | 0 | OFF | ON |  |  |
| 1 | 1 | OFF | OFF |  |  |

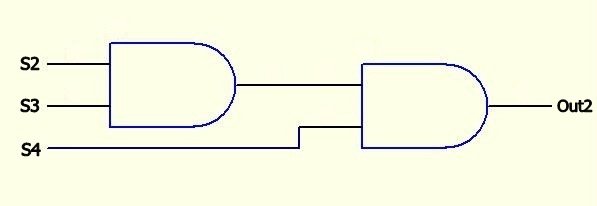
**Question:**

Do the results on experiment 1.3-1.4 agree with exercise 1.1 -1.2?

|  |
| --- |
|  |

***Part 2: More complex combinational logic***

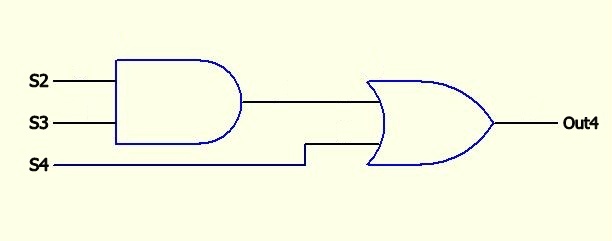
**Experiment 2.1: Fill in the truth table of the following complex logic function by experiment.**



**Out2 = (S2 AND S3) AND S4**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Inputs** | | | | | | **Output** | |
| S4 | S3 | S2 | LED4 | LED3 | LED2 | LED8 | Out2 |
| 0 | 0 | 0 | ON | ON | ON |  |  |
| 0 | 0 | 1 | ON | ON | OFF |  |  |
| 0 | 1 | 0 | ON | OFF | ON |  |  |
| 0 | 1 | 1 | ON | OFF | OFF |  |  |
| 1 | 0 | 0 | OFF | ON | ON |  |  |
| 1 | 0 | 1 | OFF | ON | OFF |  |  |
| 1 | 1 | 0 | OFF | OFF | ON |  |  |
| 1 | 1 | 1 | OFF | OFF | OFF |  |  |

**Experiment 2.2: Fill in the truth table of the following complex logic function by experiment.**



**Out4 = (S2 AND S3) OR S4**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Inputs** | | | | | | **Outputs** | |
| S4 | S3 | S2 | LED4 | LED3 | LED2 | LED10 | Out4 |
| 0 | 0 | 0 | ON | ON | ON |  |  |
| 0 | 0 | 1 | ON | ON | OFF |  |  |
| 0 | 1 | 0 | ON | OFF | ON |  |  |
| 0 | 1 | 1 | ON | OFF | OFF |  |  |
| 1 | 0 | 0 | OFF | ON | ON |  |  |
| 1 | 0 | 1 | OFF | ON | OFF |  |  |
| 1 | 1 | 0 | OFF | OFF | ON |  |  |
| 1 | 1 | 1 | OFF | OFF | OFF |  |  |

***Part 3: Motor control and sensor input***

**Experiment 3.1: Learn how to use the Smart Car system board to control motor.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Logic Inputs | | Logic Outputs | | Motor Operation |
| SW2 | SW1 | LED7 | LED8 |
| 0 | 0 |  |  |  |
| 0 | 1 |  |  |  |
| 1 | 0 |  |  |  |
| 1 | 1 |  |  |  |

**Question:**

Can you conclude from the above experiment, how the motor operation depends on the logic output 1 and logic output 2?

|  |
| --- |
|  |

**Experiment 3.2: Learn how to use the magnetic sensor to control motor.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Magnetic sensor status | Logic inputs | | Logic outputs | | Motor operation |
| SW2 | SW1 | LED7 | LED8 |
| Away from magnetic strip | 1 |  |  |  |  |
| Over the magnetic strip | 1 |  |  |  |  |

**Question:**

Can you conclude from the above experiment, what is the relation between the magnetic sensor connected on S1 and the switch SW1?

|  |
| --- |
|  |

|  |
| --- |
| ***Conclusions and discussions***  Write about 100 words on what you have learned from this laboratory exercise.  --END-- |