South China University of Technology

《Computer Organization and Architecture》Experiment Report

Experiment Title： **ALU**

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Class： 计算机全英联合班 Group： None

Collaborator： None

Teacher： 毛爱华

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| **Description** |
| 【Objective and Requirement】  Objective：  (1) Know the function and component of ALU (74LS181).  (2) Know the implementation of basic arithmetic and logical operation.  Requirement：  Use 74LS181 to execute the signed/unsigned arithmetic and logical operation.  【Environment】  Operating System：Windows XP |
| **Content** |

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| 【Procedure】   1. Step：   part of circuit diagram    Switchers:    arithmetical operation:    2. Data：   |  |  | | --- | --- | | DRA | DRB | | 0xAA | 0x55 | | 0x7A | -0x75 |  1. Major Procedure：   Before start, you need to check status of the following switches: DRA\_CLK=DRB\_CLK=0,==1, (S3,S2,S1,S0,M,CN)=(1,1,1,1,1,1).    When check complete, start simulation and switch DRA\_CLK and DRB\_CLK to write down 0xAA to data latch register DRA and 0x55 to DRB. Change the control signal set(S3,S2,S1,S0,M,CN), make =0,Observe the output and flags. Record them to the next page’s table to verify the function of 74LS181.  Write 0xAA to DRA and 0x55 to DRB:     |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | DRA | DRB | S3 | S2 | S1 | S0 | M=0(算术运算) | | 标志位CF/ZF/SF | | M=1 逻辑运算 | | CN=1无进位 | CN=0有进位 | CN=1无进位 | CN=0无进位 | |  | | 0xAA | 0x55 | 0 | 0 | 0 | 0 | F=0xAA | F=0xAB | 0/0/1 | 0/0/1 | F=0x55 |  | | 0xAA | 0x55 | 0 | 0 | 0 | 1 | F=0xFF | F=0x00 | 0/0/1 | 1/1/0 | F=0x00 |  | | 0xAA | 0x55 | 0 | 0 | 1 | 0 | F=0xAA | F=0xAB | 0/0/1 | 0/0/1 | F=0x55 |  | | 0xAA | 0x55 | 0 | 0 | 1 | 1 | F=0xFF | F=0x00 | 0/0/1 | 1/1/0 | F=0x00 |  | | 0xAA | 0x55 | 0 | 1 | 0 | 0 | F=0x54 | F=0x55 | 1/0/0 | 1/0/0 | F=0xFF |  | | 0xAA | 0x55 | 0 | 1 | 0 | 1 | F=0xA9 | F=0xAA | 1/0/1 | 1/0/1 | F=0xAA |  | | 0xAA | 0x55 | 0 | 1 | 1 | 0 | F=0x54 | F=0x55 | 1/0/0 | 1/0/0 | F=0xFF |  | | 0xAA | 0x55 | 0 | 1 | 1 | 1 | F=0xA9 | F=0xAA | 1/0/1 | 1/0/1 | F=0xAA |  | | 0xAA | 0x55 | 1 | 0 | 0 | 0 | F=0xAA | F=0xAB | 0/0/1 | 0/0/1 | F=0x55 |  | | 0xAA | 0x55 | 1 | 0 | 0 | 1 | F=0xFF | F=0x00 | 0/0/1 | 1/1/0 | F=0x00 |  | | 0xAA | 0x55 | 1 | 0 | 1 | 0 | F=0xAA | F=0xAB | 0/0/1 | 0/0/1 | F=0x55 |  | | 0xAA | 0x55 | 1 | 0 | 1 | 1 | F=0xFF | F=0x00 | 0/0/1 | 1/1/0 | F=0x00 |  | | 0xAA | 0x55 | 1 | 1 | 0 | 0 | F=0x54 | F=0x55 | 1/0/0 | 1/0/0 | F=0xFF |  | | 0xAA | 0x55 | 1 | 1 | 0 | 1 | F=0xA9 | F=0xAA | 1/0/1 | 1/0/1 | F=0xAA |  | | 0xAA | 0x55 | 1 | 1 | 1 | 0 | F=0x54 | F=0x55 | 1/0/0 | 1/0/0 | F=0xFF |  | | 0xAA | 0x55 | 1 | 1 | 1 | 1 | F=0xA9 | F=0xAA | 1/0/1 | 1/0/1 | F=0xAA |  |   Explanation: Do the operation according to the arithmetical operation table above then get the final result. Be careful that the difference between the arithmetic and logical operation. Arithmetic operation is the operation likes add, subtrate, multiple and so on. Logical operation is the operation like and, or , xor and so on. We also should know that CF means “carry flag” which means whether the arithmetic operation has the overflow. ZF means “zero flag” which means whether the final result is equal to 0. It lights when the result is 0. And the SF means the “sign flag” which lights when the result is negative.  Do the same operation to write down 0x7A to DRA and -0x75 to DRB. Observe and record the result.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | DRA | DRB | S3 | S2 | S1 | S0 | M=0(算术运算) | | 标志位CF/ZF/SF | | M=1 逻辑运算 | | CN=1无进位 | CN=0有进位 | CN=1无进位 | CN=0无进位 | |  | | 0x7A | -0x75 | 0 | 0 | 0 | 0 | F=0x7A | F=0x7B | 0/0/0 | 0/0/0 | F=0x85 |  | | 0x7A | -0x75 | 0 | 0 | 0 | 1 | F=0xFB | F=0xFC | 0/0/1 | 0/0/1 | F=0x04 |  | | 0x7A | -0x75 | 0 | 0 | 1 | 0 | F=0x7E | F=0x7F | 0/0/0 | 0/0/0 | F=0x81 |  | | 0x7A | -0x75 | 0 | 0 | 1 | 1 | F=0x00 | F=0xFF | 0/0/1 | 1/1/0 | F=0x00 |  | | 0x7A | -0x75 | 0 | 1 | 0 | 0 | F=0xEA | F=0xEB | 0/0/1 | 0/0/1 | F=0xF5 |  | | 0x7A | -0x75 | 0 | 1 | 0 | 1 | F=0x6B | F=0x6C | 1/0/0 | 1/0/0 | F=0x74 |  | | 0x7A | -0x75 | 0 | 1 | 1 | 0 | F=0xEE | F=0xEF | 0/0/1 | 0/0/1 | F=0xF1 |  | | 0x7A | -0x75 | 0 | 1 | 1 | 1 | F=0x6F | F=0x70 | 1/0/0 | 1/0/0 | F=0x70 |  | | 0x7A | -0x75 | 1 | 0 | 0 | 0 | F=0x84 | F=0x85 | 0/0/1 | 0/0/1 | F=0x8F |  | | 0x7A | -0x75 | 1 | 0 | 0 | 1 | F=0x05 | F=0x06 | 1/0/0 | 1/0/0 | F=0x0E |  | | 0x7A | -0x75 | 1 | 0 | 1 | 0 | F=0x88 | F=0x89 | 0/0/1 | 0/0/1 | F=0x8B |  | | 0x7A | -0x75 | 1 | 0 | 1 | 1 | F=0x09 | F=0x0A | 1/0/0 | 1/0/0 | F=0x0A |  | | 0x7A | -0x75 | 1 | 1 | 0 | 0 | F=0xF4 | F=0xF5 | 0/0/1 | 0/0/1 | F=0xFF |  | | 0x7A | -0x75 | 1 | 1 | 0 | 1 | F=0xF5 | F=0xF6 | 1/0/0 | 1/0/0 | F=0x7E |  | | 0x7A | -0x75 | 1 | 1 | 1 | 0 | F=0xF8 | F=0xF9 | 0/0/1 | 0/0/1 | F=0xFB |  | | 0x7A | -0x75 | 1 | 1 | 1 | 1 | F=0x79 | F=0x7A | 1/0/0 | 1/0/0 | F=0x7A |  |   Explanation: Do the operation like the above. Be careful that the binary bits of the -0x75 is 10001011 in two’s complement. So, the ALU do the operation by 10001011. |
| **Conclusion** |
| After finishing the experiment, I have learned the function and the component of ALU 74LS181, which contains the function of logical and arithmetic operation as the function table above. We can select the function and the operation of the 74LS181(the integrate chip) to help us achieve different kinds of operation by changing the value of Sx, M and CN. I also learn how the logical and arithmetic operation implement like the XOR, complement of the logical operation and the plus, minus in arithmetic operation. Additionally, I learned the usage and how they work the different flag including carry flag, zero flag and the sign flag. I also learn how to connect the circuit for me to implement the 3 kinds of flag. |
| **Teacher’s Comments and Score** |
| Comment：  Score：           Signature：                                                 Date： |