# 國立彰化師範大學 99 學年度碩士班招生考試試題

系所：電子工程學系　　組別：乙組(選考乙)　　科目：計算機組織

☆☆請在答案紙上作答☆☆　　

1. Given the pattern: 1000 1111 1110 1111 1100 0000 0000 0000
   A. (5%) What does it represent as a 2's complement integer?
   B. (5%) What does it represent as a single precision floating-point number?

2. (10%) Design a sequential circuit using JK flip-flops for state diagram Fig. 1 and state assignment: $A$ = 00, $B$ = 01, $C$ = 11, and $D$ = 10 .

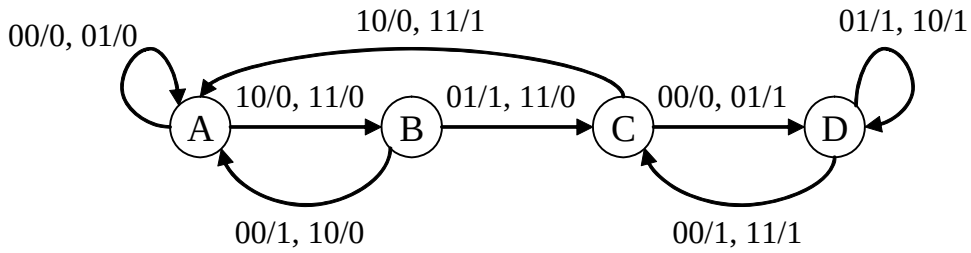


Fig. 1 State diagram

3. (10%) Derive the state table and state diagram of the Fig. 2 circuit.

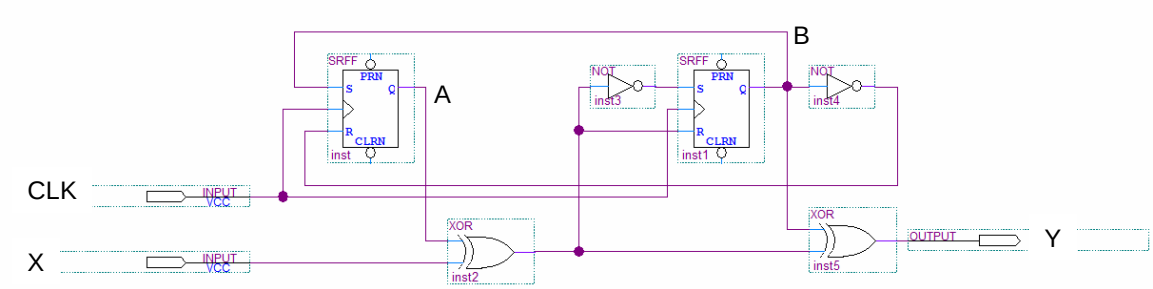


Fig. 2 Sequential circuit

4. (10%) Referring to Fig. 3, design an adder to add two decimal digits (4-bit BCD code).

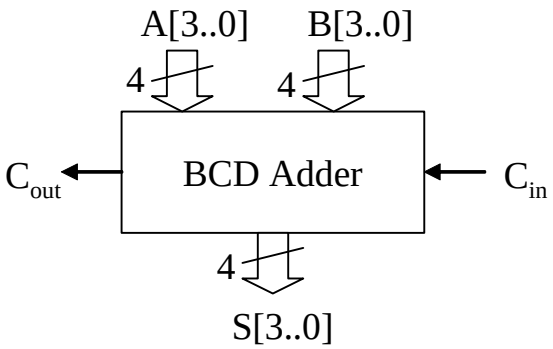


Fig. 3 BCD adder

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5. (10%) Simplify the following expressions:
   A. (xy'+z)(x+y')z
   B. A'C'D'+AC'+BCD+A'CD'+A'BC+AB'C'

6. (10%) Translate the following C code segment into MIPS assembly code

```
while ( j < 10)
    {if ( j%2 == 0)
        sum_e = sum_e + A[j];
     else
        sum_o = sum_o + A[j];
    j=j+1; }
```

   Assume variable *j* is already assigned to *R1*, variable *sum_e* is already assigned to *R2*; variable *sum_o* is already assigned to *R3*, and the start address of integer array *A* is already stored in *R4*.

7. (10%) Consider two different implementations of the same instruction set architecture. There are four classes of instructions, A, B, C, and D. The clock rate and CPI (cycles per instruction) of each implementation are given in the following table. Given a program with $10^8$ instructions divided into classes as follows: 20% class A, 30% class B, 40% class C, and 10% class D. (a) Find the average CPI for P1; (b) Find the average CPI for P2; (c) Find the execution time for P1; (d) Find the execution time for P2.

| | clock rate | CPI class A | CPI class B | CPI class C | CPI class D |
|---|---|---|---|---|---|
| P1 | 2.6GHz | 1 | 2 | 1 | 4 |
| P2 | 1.5GHz | 2 | 3 | 1 | 2 |

8. (20%) Explain the following terms in detail: (a) Write After Read hazard (b) Set associative cache (c) Static instruction scheduling (d) Register renaming.

9. (10%) The microarchitecture of MIPS R2000 is shown in Fig. 4 (This figure comes from the book '*Computer Organization and Design*' by D.A. Patterson and J.L. Hennessy). Assume MIPS R2000 is to execute the instruction 'LW R3, 100(R1)', assign appropriate values for the following control signals: (a) ALUSrc (b) RegWrite (c) MemWrite (d) MemRead (e) MemtoReg.

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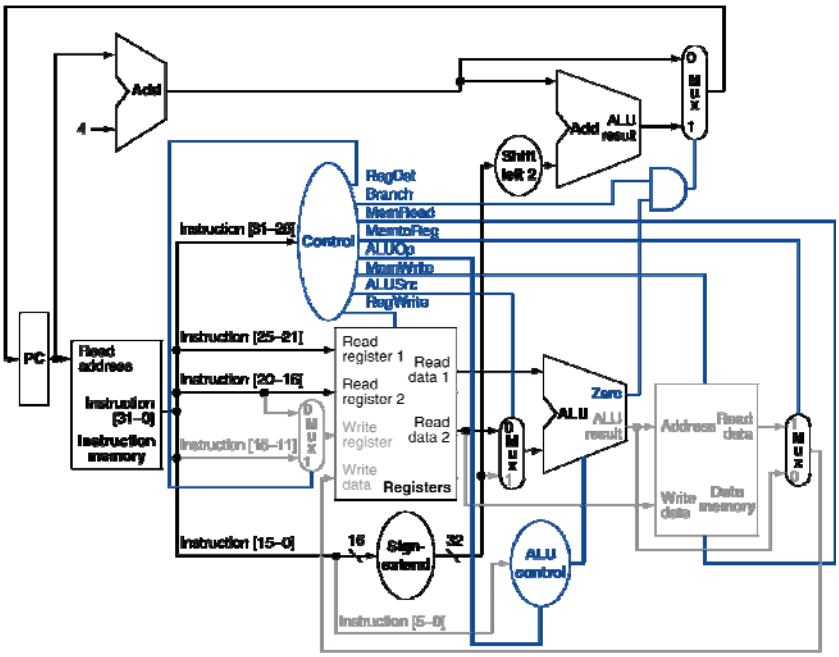


Fig. 4 The microarchitecture of MIPS R2000