

# Digital Logic

## CS207 Assignment 3

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. 29, 2022**



南方科技大学  
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

# Assignment Notes

- Write neatly according to the answer template and submit an e-copy to Sakai on time.
  - You can finish the theory questions on a paper, scan it and paste into the template.
- 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.
- This document accounts for 100% of the assignment.
- Request to regrade will lead to a complete regrade on all questions in the assignment. Final grades may increase or decrease.

# Question 1

- (20 points) A PN flipflop has four operations: clear to 0, no change, complement, and set to 1, when inputs P and N are 00, 01, 10, and 11, respectively.
  - ① Tabulate the characteristic table.
  - ② Derive the characteristic equation.
  - ③ Tabulate the excitation table.
  - ④ Show how the PN flipflop can be converted to a D flipflop.

## Question 2

- (20 points) A sequential circuit has two JK flip-flops  $A$  and  $B$  and one input  $x$ . The circuit is described by the following flip-flop input equations:  $J_A = x'$ ,  $K_A = B$ ,  $J_B = x$ ,  $K_B = A'$ .
  - ① Derive the state equations  $A(t+1)$  and  $B(t+1)$  by substituting the input equations for the  $J$  and  $K$  variables. Draw the state diagram of the circuit.

## Question 3

- (20 points) A sequential circuit has two JK flipflops  $A$  and  $B$ , two inputs  $x$  and  $y$ , and one output  $z$ . The flipflop input equations and circuit output equation are  $J_A = Bx' + B'y$ ,  $K_A = Bx' + y'$ ,  $J_B = Ax'$ ,  $K_B = A + xy'$ ,  $z = Axy + Bx'y'$ .
  - ① Draw the logic diagram of the circuit.
  - ② Tabulate the state table.
  - ③ Derive the state equations for  $A$  and  $B$ .

## Question 4

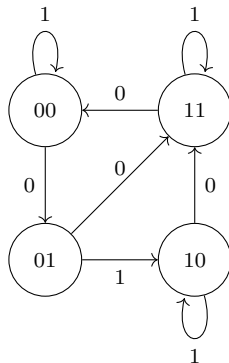
- (20 points) For the following state table

| Present State | Next State |         | Output  |         |
|---------------|------------|---------|---------|---------|
|               | $x = 0$    | $x = 1$ | $x = 0$ | $x = 1$ |
| $a$           | $f$        | $b$     | 0       | 0       |
| $b$           | $d$        | $c$     | 0       | 0       |
| $c$           | $f$        | $e$     | 0       | 0       |
| $d$           | $g$        | $a$     | 1       | 0       |
| $e$           | $d$        | $c$     | 0       | 0       |
| $f$           | $f$        | $b$     | 1       | 1       |
| $g$           | $g$        | $h$     | 0       | 1       |
| $h$           | $g$        | $a$     | 1       | 0       |

- 1 Draw the corresponding state diagram.
- 2 Tabulate the reduced state table.
- 3 Draw the state diagram corresponding to the reduced state table.
- 4 Determine the output sequence for input sequence 01010010111 (from left to right) with the original state table and the reduced state table, starting from  $a$ .

## Question 5

- (20 points) Obtain the simplified input equations for a sequential circuit that uses T flip-flops and is specified by the state diagram below.



Hooray! There is no lab questions  
in this assignment!

It means that you'd better spend more time on your project, though.