

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING



Examination : Final - Session 1
Date : 2 October 2003
Subject : 240-205 Digital Systems and Logic Design

Year : 2003
Time : 9.00-12.00
Room :

NOTE

- There are 7 questions 13 pages. Answer all questions
- All questions are of different values.
- Calculator, textbooks and hand-out are prohibited.
- Every answer must be clear and show how to get the answer.
- All answers must be given in ink.
- Unless otherwise indicated, pencils should only be used for graphical work.

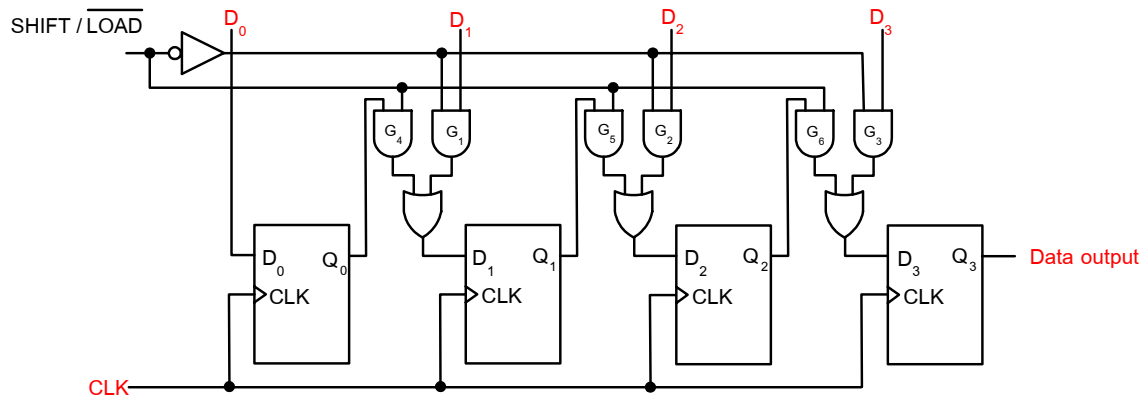
Student ID : _____ Name : _____ Section : _____

Question	Points	
1	8	
2	5	
3	12	
4	10	
5	10	
6	5	
7	20	
Total	70	

1. Determine the state of each flip-flop waveform of figure 1 (a) after each clock pulse. The Data, clock and SHIFT/LOAD waveforms are given in figure 1 (b). Assume that the flip-flops are initially RESET.

(8 points)

(a) Logic diagram



(b)

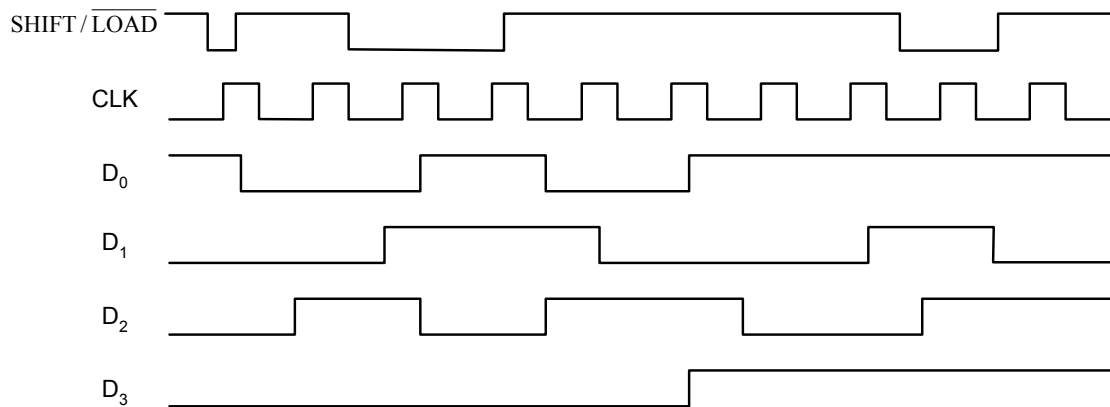


Figure 1

Answer

Q₀ -----

Q₁ -----

Q₂ -----

Q₃ -----

2. Determine the frequency at output X and Q_D in figure 2 when input clock is 8.64 kpps. (5 points)

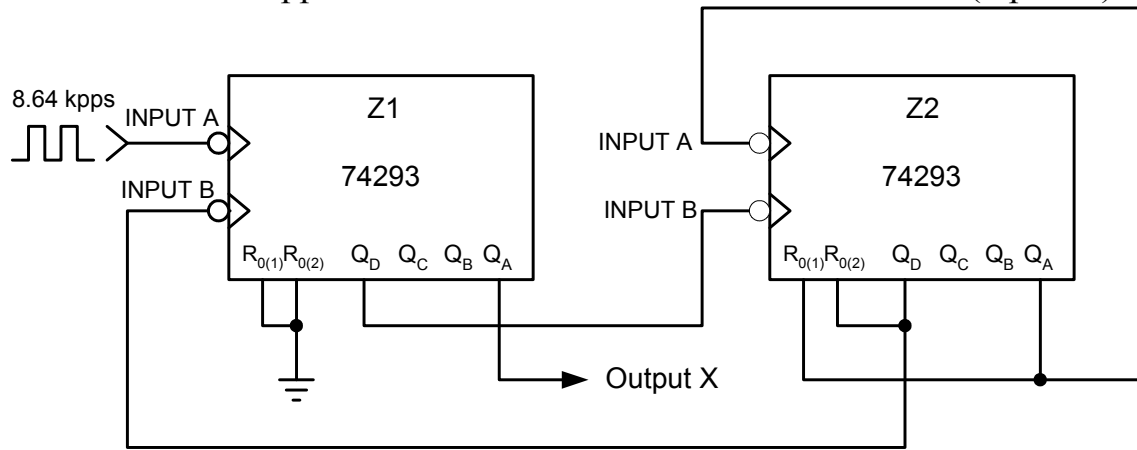
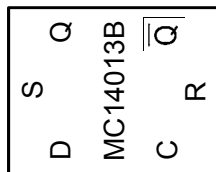
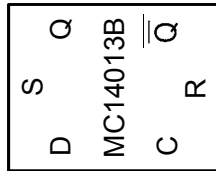
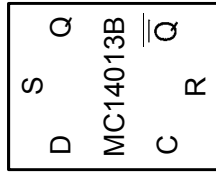


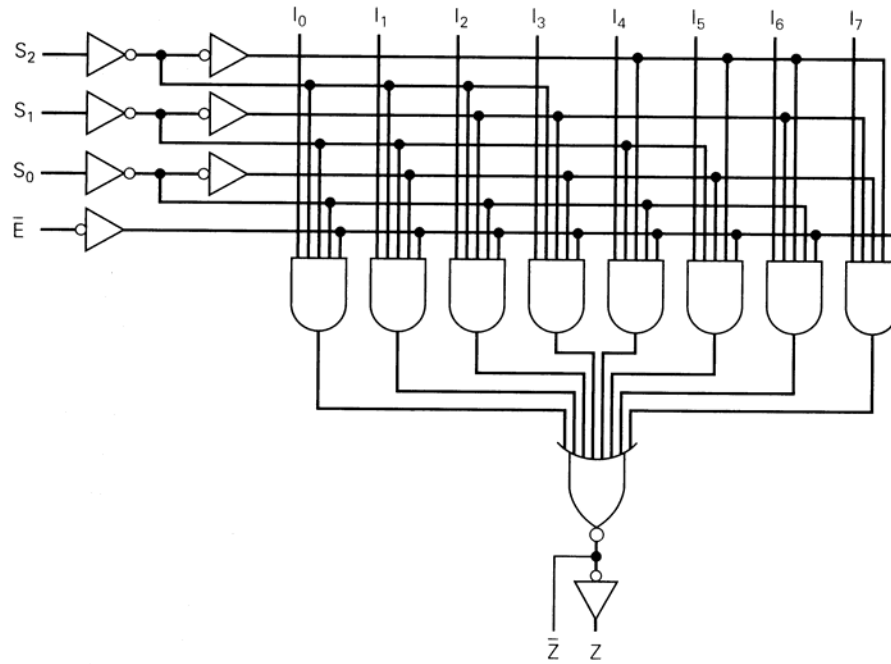
Figure 2

Answer _____

(b) Draw a logic diagram of the problem 7 (a) (10 points)



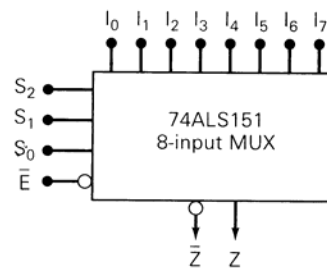
Appendix



(a)

Inputs				Outputs	
\bar{E}	S_2	S_1	S_0	\bar{Z}	Z
H	X	X	X	H	L
L	L	L	L	\bar{I}_0	I_0
L	L	L	H	\bar{I}_1	I_1
L	L	H	L	\bar{I}_2	I_2
L	L	H	H	\bar{I}_3	I_3
L	H	L	L	\bar{I}_4	I_4
L	H	L	H	\bar{I}_5	I_5
L	H	H	L	\bar{I}_6	I_6
L	H	H	H	\bar{I}_7	I_7

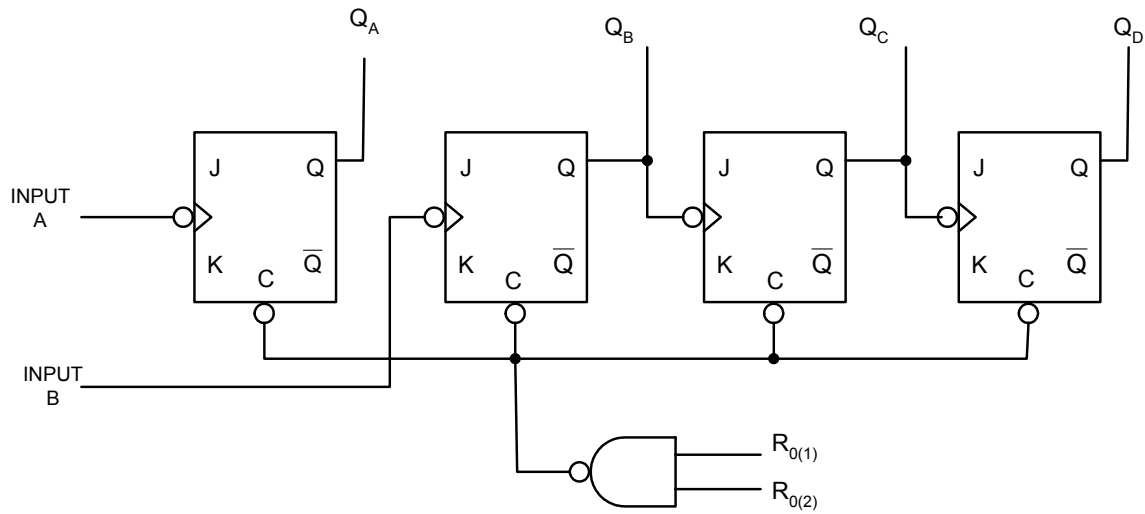
(b)



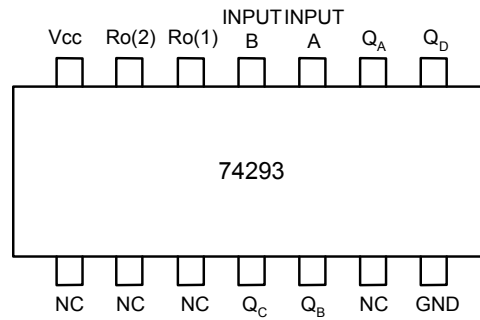
(c)

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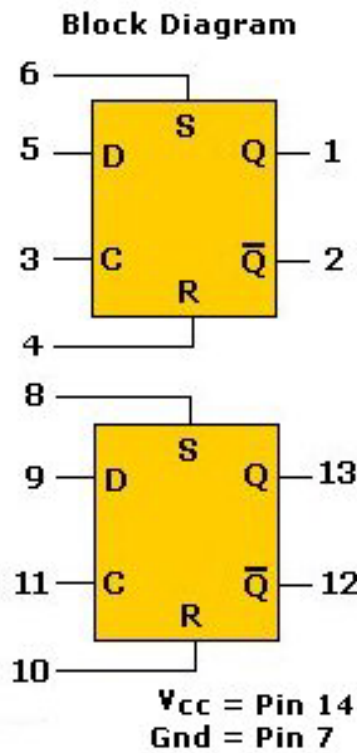


RESET INPUTS		OUTPUT			
R0(1)	R0(2)	Q _D	Q _C	Q _B	Q _A
H	H	L	L	L	L
L	X	L	L	L	H
X	L	L	L	H	L



Count	OUTPUT			
	Q _D	Q _C	Q _B	Q _A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

MC14013B Dual Type D Flip-Flop



Truth Table

Inputs				Outputs		
clock [†]	data	reset	set	Q	\bar{Q}	
	0	0	0	0	1	
	1	0	0	1	0	
	X	0	0	Q	\bar{Q}	no change
X	X	1	0	0	1	
X	X	0	1	1	0	
X	X	1	1	1	1	

X = Don't Care
† = Level Change

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