ELEC 2607 (`13) **Midterm 2** (Mar 9th 2013) 60 Marks

Answer all 8 questions. Write your answers in the space provided on the question paper. Anything written on the reverse side won't be marked.

Authorized Memoranda: One crib sheet allowed per student; maximum letter-size paper. Crib sheet can be filled on both sides. Calculators are NOT allowed.

Name:

Student No.:

Section:

Instructors

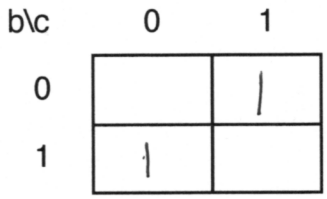
Pavan Gunupudi

Maitham Shams

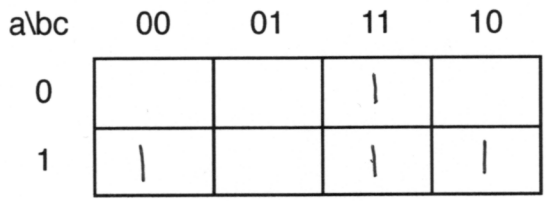
	Q1	Q1	Q3	Q4	Q5	Q6	Q7	Q8	Total
Marks									

1. Draw K-Maps for the following boolean expressions (6 marks)

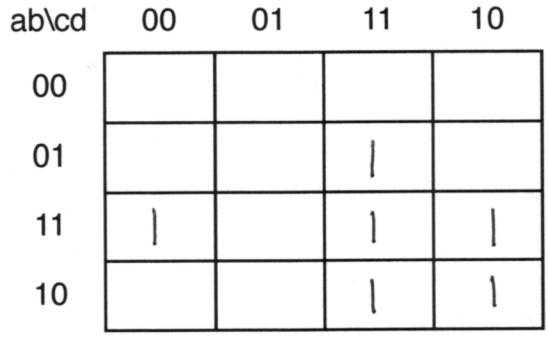
a) $b\bar{c} \oplus \bar{b}c$



b) $\bar{a}bc + a\bar{c} + ba$



c) $\bar{d}ab + bcd + ca$



2. Loop the following K-Maps without extra loops and write the corresponding equation. You will be penalized for any extra terms. (8 marks)

ab\c	0	1
00	1	
01	1	1
11		d
10	1	

$\bar{a}b + \bar{c}\bar{b}$

ab\cd	00	01	11	10
00	1			d
01		1	d	
11		d	1	
10	1	d	d	1

$bd + \bar{b}\bar{d}$

3. Loop the following XK-Maps without extra loops and write the corresponding equation. You will be penalized for any extra terms. (8 marks)

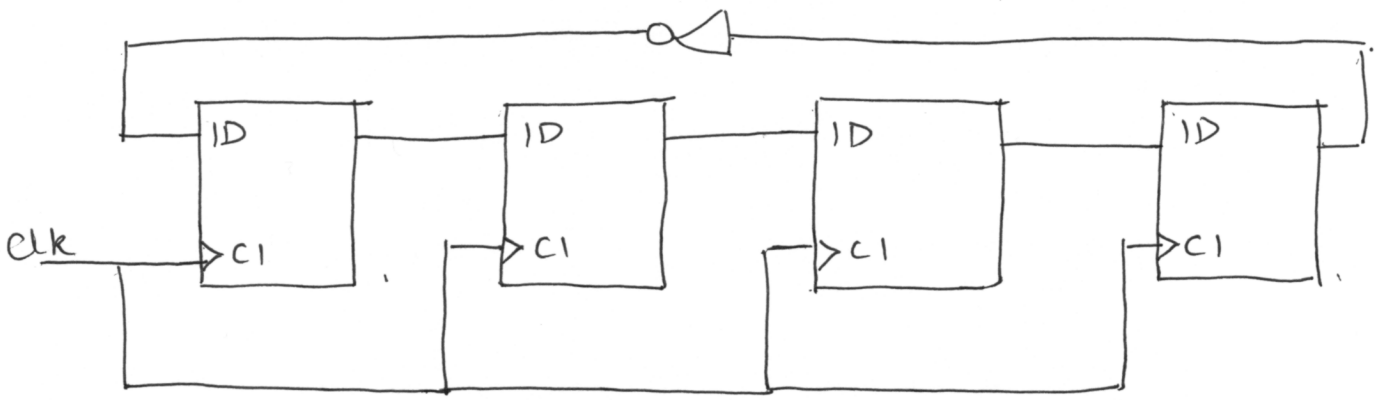
ab\c	0	1
00		d
01	1	
11	1	
10		1

$b \oplus c$

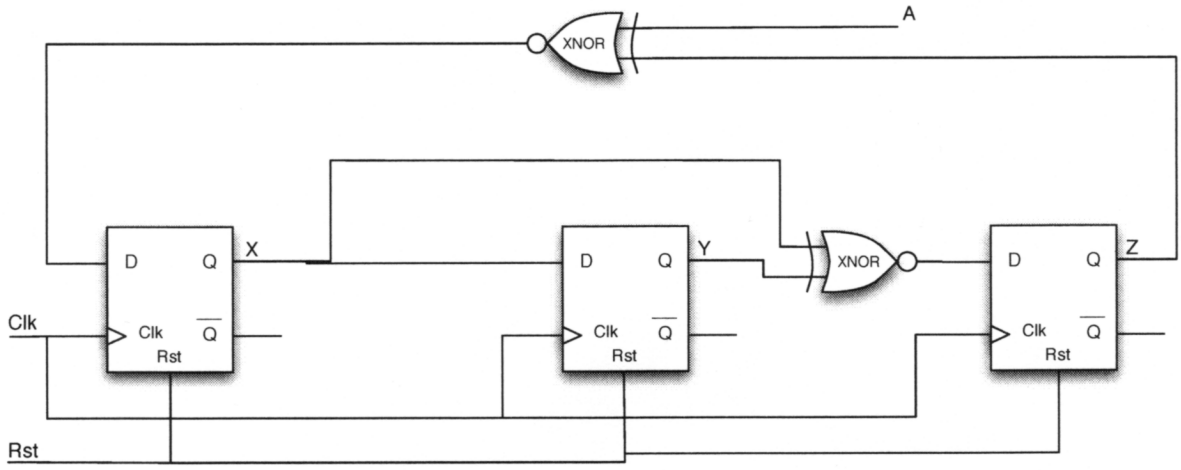
ab\cd	00	01	11	10
00			1	
01	1	d	1	1
11		1		
10			1	

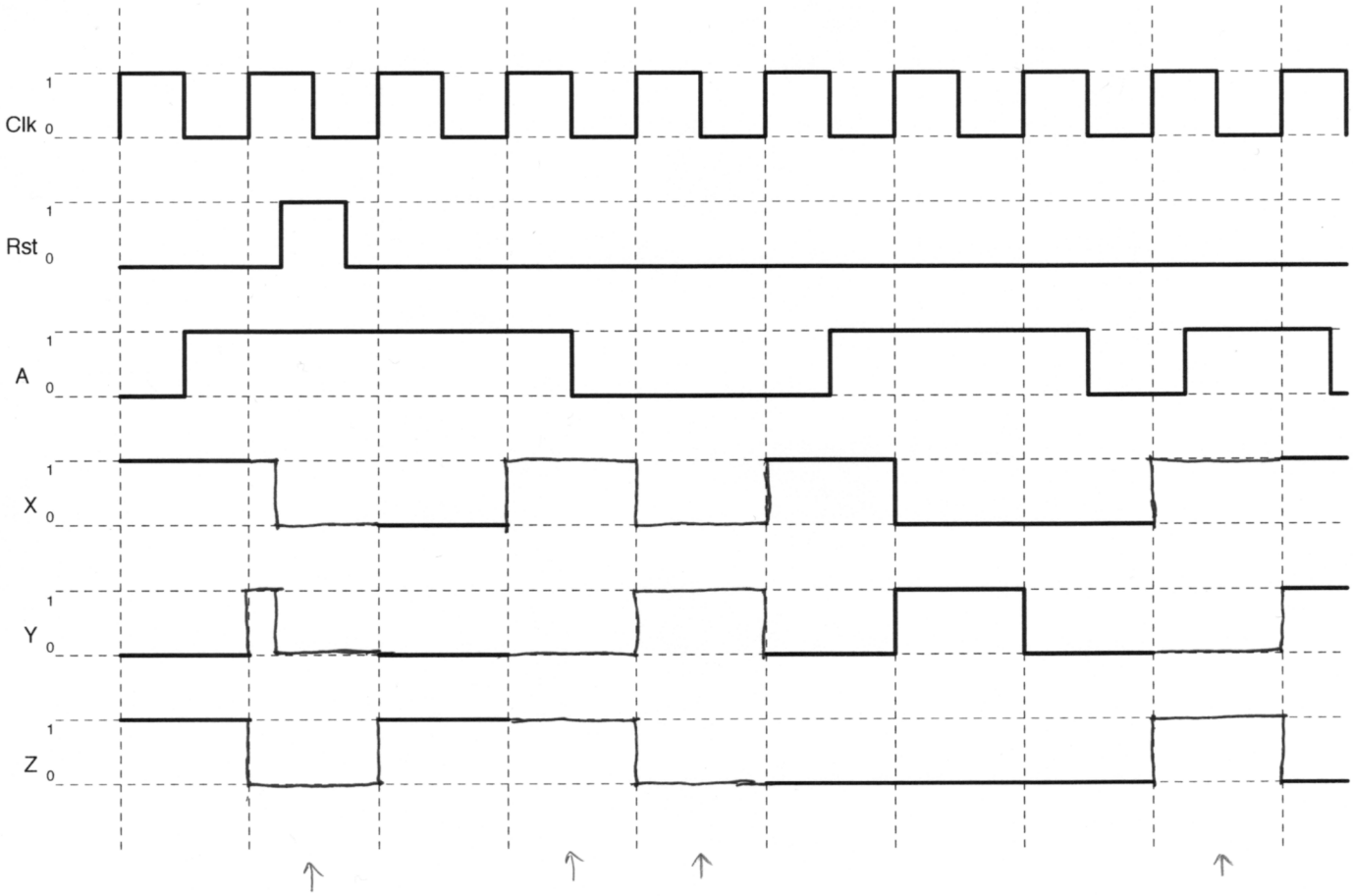
$\bar{a}b \oplus cd \oplus bd$

4. Design a circuit made of rising-edge-triggered flip-flops and inverter(s) such that its output has one-eighth (1/8) of the clock frequency. You will be penalized for any extra logic gates used. (4 marks)

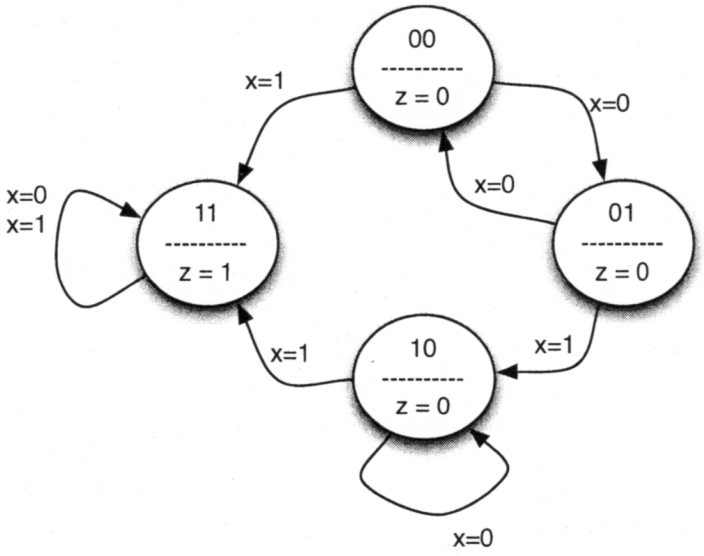


5. Complete the following diagram for the depicted circuit by drawing the missing waveforms for the 4 clock cycles. The flip-flops have asynchronous resets. (12 marks)



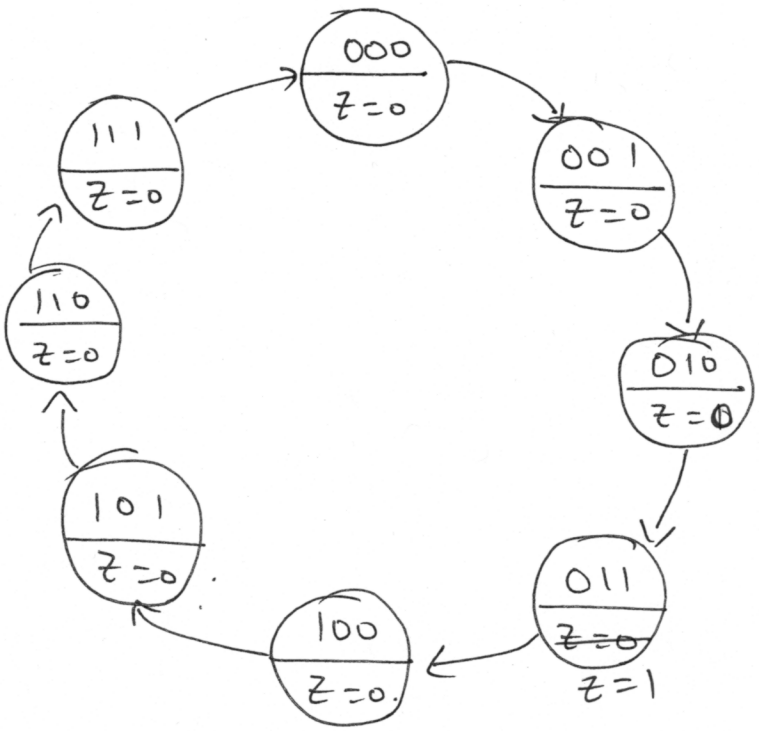


6. Form the state table for the following state diagram. The present state is given by the state variables Q1 and Q0 and the next state variables are given by $Q1^+$ and $Q0^+$. The output is z. (8 marks)



		x=0		x=1		
Q1	Q0	$Q1^+$	$Q0^+$	$Q1^+$	$Q0^+$	z
0	0	0	1	1	1	0
0	1	0	0	1	0	0
1	1	1	1	1	1	1
1	0	1	0	1	1	0

7. Draw the state-graph of a finite state machine which starts at state 000 and sends a pulse (i.e. output z=1) on the 3rd clock cycle and every 8th cycle thereafter; z is zero for all other clock cycles. You are allowed to use a maximum of 8 states to design this finite state machine. (5 marks)



8. Fill the K-Maps below using the information present in the state table. No looping necessary. (9 marks)

	Next State	
Present state	**x=0**	**x=1**
$Q_2Q_1Q_0$	**$Q_2^+Q_1^+Q_0^+$**	**$Q_2^+Q_1^+Q_0^+$**
000	101	001
001	000	010
011	010	100
010	001	011
100	011	101
101	100	000
111	ddd	ddd
110	ddd	ddd

Q_0^+

$Q_1Q_0 \backslash Q_2x$	00	01	11	10
00	1	1	1	1
01				
11			d	d
10	1	1	d	d

Q_1^+

$Q_1Q_0 \backslash Q_2x$	00	01	11	10
00				1
01		1		
11	1		d	d
10		1	d	d

Q_2^+

$Q_1Q_0 \backslash Q_2x$	00	01	11	10
00	1		1	
01				1
11		1	d	d
10			d	d