EECS 42 – Introduction to Electronics for Computer Science

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Course Web Site http://www-inst.EECS.Berkeley.EDU/~ee42/

Midterm #2 April 16th, 2003

Closed Book, Closed Notes
Device Equations on Device Problem
Write on the Exam paper

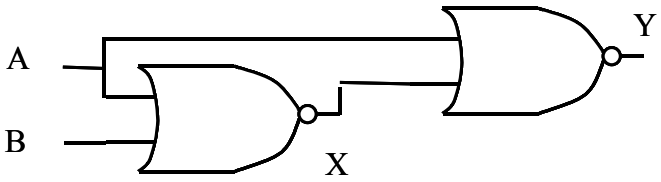
Print Your Name:_____

Sign Your Name:_____

Show your work so that the method as well as the answer can be graded for correctness and completeness. Correct answers alone are only worth 70% of full credit.

Problem	Possible	Score
I	30	
II	35	
III	35	
Total	100	

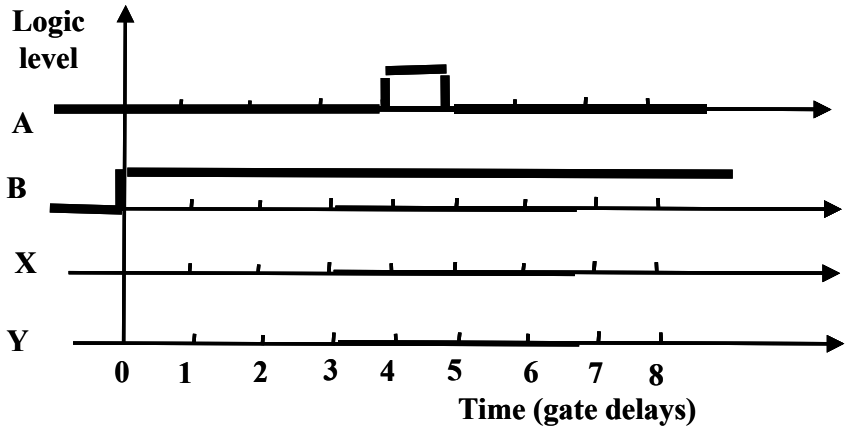
I (30 Points) Logic and Timing Diagrams



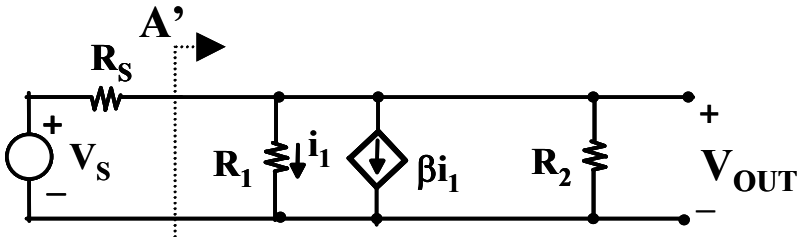
a) (12 points) Complete the truth table.

A	B	X	Y
0	0		
1	0		
0	1		
1	1		

b) (18 points) Complete the timing diagram for all eight gate delays.



II (35 Points) Dependent Sources



a) (15 points) Find V_{OUT} in terms of V_S, the resistors and the dependent source strength β.

b) (12 points) Find the resistance seen looking to the right of AA' in terms of the resistors and the dependent source strength β.

c) (8 points) Does increasing β raise or lower the resistance in part b)? Give a brief intuitive explanation of how this occurs.

III (35 Points) Logic Circuit with a EE42 Device

$$I_{OUT-SAT-D} = k_D(V_{IN} - V_{TD})V_{OUT-SAT-D}$$

Values for this Exam

k_D = 40 μA/V^2 **k_U = 30 μA/V^2**

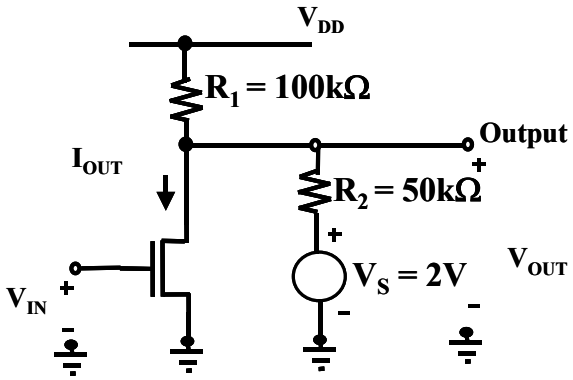
V_{TD} = 2V **V_{TU} = 1.5V**

$V_{OUT-SAT-D}$ = 0.5V **$V_{OUT-SAT-U}$= 1.5V**

$$I_{OUT-SAT-U} = k_U\left(V_{DD} - V_{IN} - V_{TU}\right)V_{OUT-SAT-U}$$

When in circuit attached to VDD.

a) (12 points) Remove the EE42 pull-down device from this circuit and consider the remaining circuit. Find the **open circuit voltage** and **short circuit current** that is seen looking out from the position of the pull-down EE42 device into the remaining circuit.



b) (11 points) Now consider the EE 42 device alone with the parameter values given. If V_{IN} is limited to a range of 0 to 5V and V_{OUT} is limited to a range of 0 to 5V, what will be the maximum current?

c) (12 points) Now consider the EE 42 device and circuit connected together. Find V_{OUT} when V_{IN} = 3V. You may use either a graphical or an algebraic method.