¡Anota tu nombre y número de sección en <u>todas las hojas</u> del examen AHORA! (penalidad de 5 puntos)

Tienes 2 horas para completar todos los problemas. Lee cuidadosamente todo el examen antes de empezar a trabajar. Muestra todo el trabajo conducente a tu contestación. Podrás recibir crédito parcial por contestaciones parciales siempre y cuando muestres tu trabajo por escrito. Usa tu tiempo inteligentemente. Exito!

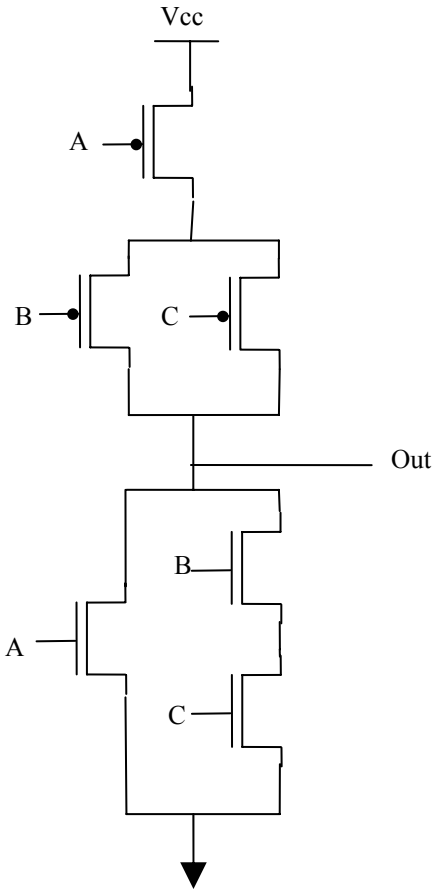
INEL 4206 Staff

INEL 4206 Fall 2002 Exámen I 5/13/03

1	20
2	25
3	25
4	20
5	10
Total	100

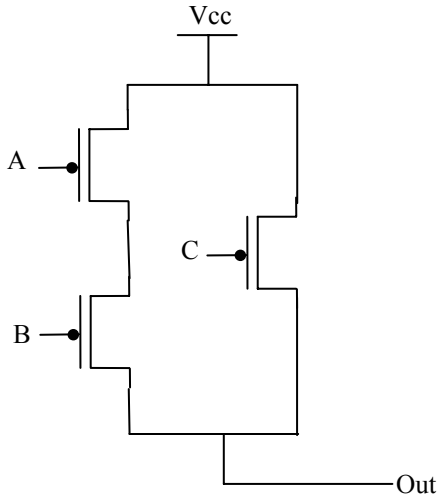
Problem 1. (20 points) CMOS Technology

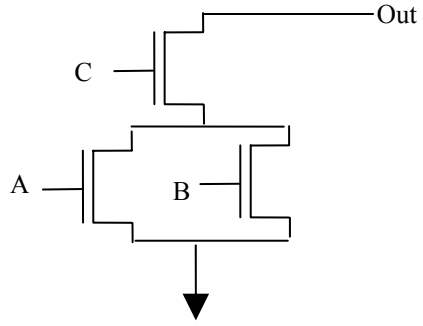
(a) (10 points) Given the following CMOS technology circuit, write its Boolean equation.



$F(A,B,C) = \text{NOT}\,(A + (B \cdot C))$

(b) **(10 points)** Given the following pull-up Network, determine the pull-down network and provide a simplified Boolean equation:

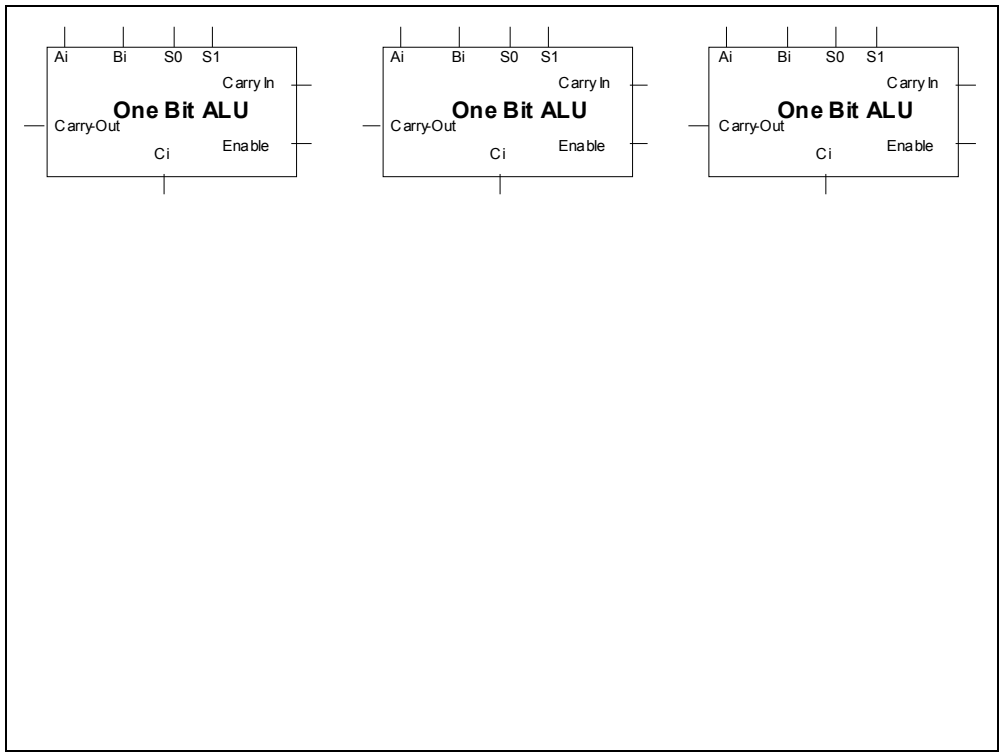




$F(A,B,C) = \text{NOT}(C \cdot (A + B))$

Problema 2. (25 points) Problem Set I

a) **(15 points)** Given three One Bit ALU's with the same specifications as the ones you constructed for Problem Set 1, add any necessary components and make the proper connections between them so all operations (Add, XOR, Rotate Right and Rotate Left) can be performed using the carry-outs and carry-ins for transferring data between 1-bit ALU's. This should be very familiar as it is what you did for problem 2 of the Problem Set 1, only this time it's only 3 1-bit ALU's instead of 4.



b) **(10 points)** Assuming that all combinational components used above have minimal delay, what is the delay for each of the following elements as a function of the delay τ of one level (delay through one gate) of combinational logic:

a. The one-bit ALU:

$F(\tau) = 3\tau$

b. A 2:1 Multiplexer:

$F(\tau) = 3\tau$

c. The three bit ALU:

$F(\tau) = 18\tau$

Problema 3. (25 points) The Nature of Information

Consider the following segment of C code.

C Code

```
int a =9;
int b = 4;
int c=0;

while(a>=0){
  a=a-b;
}

c=a+b;
```

Assume that the variables are stored in the following memory locations:

Variable	Location	Initial Value
a	100	9
b	102	4
c	104	0

a) **(15 points)** Translate the C code segment into an equivalent Easy I assembly language segment starting at location 110:

Location	Easy I Instructions
110	LOOP: LOADi 100
112	BRNi END
114	LOADi 102
116	COMP
118	ADDi 1
120	ADD 100
122	STOREi 100
124	JUMP 110
126	END: ADD 102
128	STOREi 104
130	
132	
134	
136	
138	
140	
142	
144	
146	
148	
150	

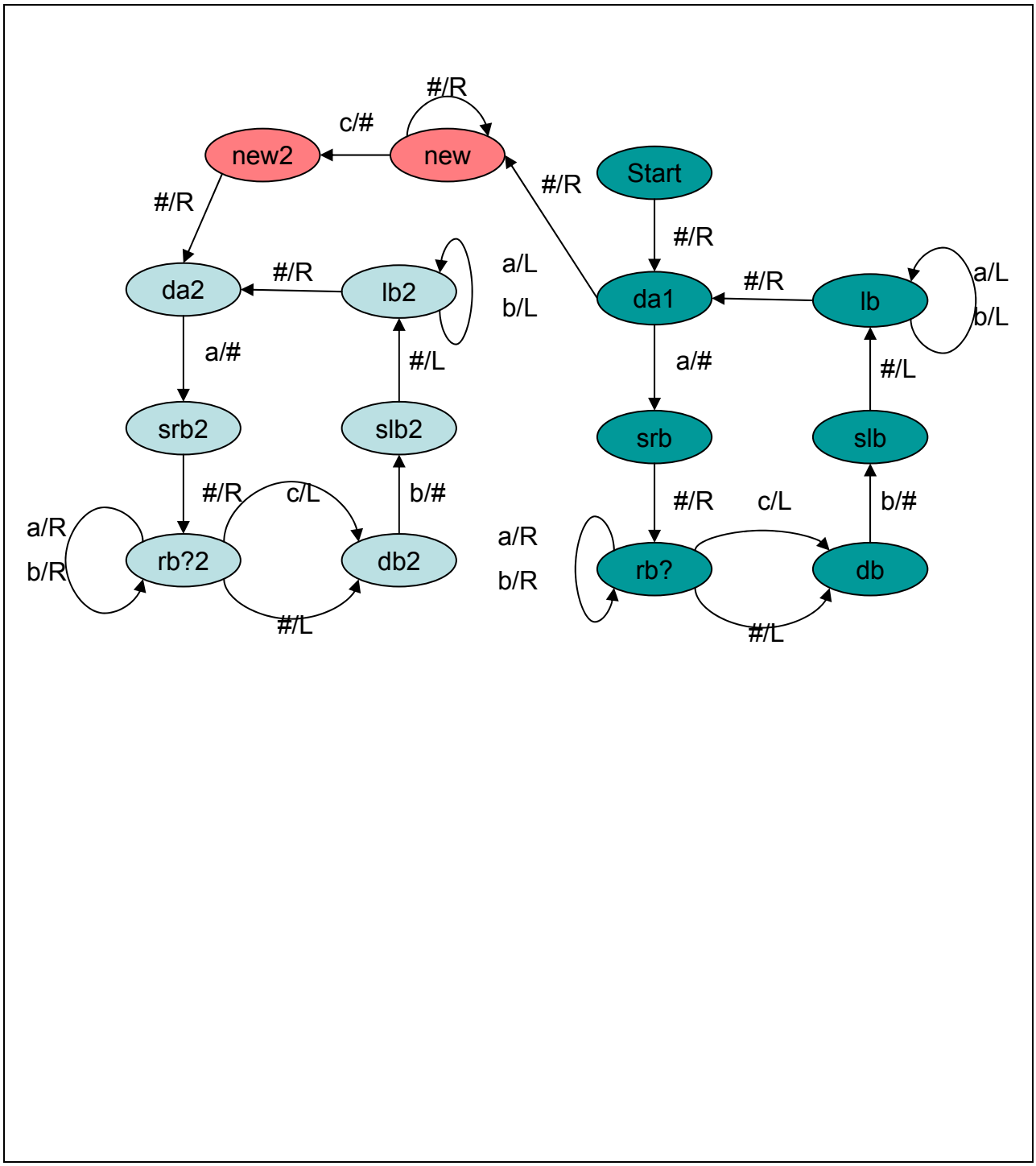
b) **(10 points)** Describe the value computed by the segment in variable **c** as a mathematical function of the variables **a** and **b**:

c = a modulo b (remainder of a divided by b)

Problem 4. (20 points) Computing Models

Consider the following Turing Machine example discussed in class (Appendix B)

a) **(10 points)** Modify the TM's finite state machine to recognize the language $a^n b^n c a^m b^m$ for any n and any m.



b) **(10 points)** Provide a new version of the TM state transition table:

Current state	Input tape symbol	Action	Next state
start	#	R	da

Problem 5. (10 points) Course Evaluation

Es importante que completes esta parte con la mayor seriedad e interés posibles. Tu contribución ayudará a mejorar la calidad del curso significativamente.

Gracias.

1) Menciona los tres aspectos que mas te gustan de la clase INEL 4206

a)

b)

c)

2) Menciona los tres aspectos que menos te gustan de la clase INEL 4206

a)

b)

c)

Appendix A. Easy I processor essentials

Appendix B. Turing Machine Example discussed in class