December 13, 1995

cs330 - Discrete Structures
Fall 1995 - sections 001 & 091

Final Exam
open books, open notes

Starts: **2:00 pm**
Ends**: 3:00 pm**

Name:____________________________________(please print)
ID:________________________

What to you think is the grade that best reflects your activity in this class:

Problem			
1	10 points	__	(5+5)
2	10 points	__	(5+5)
3	5 points	__	
4	30 points	__	(6*5)
5	35 points	__	(5+5*5+5)
6	10 points	__	
	Total	__ / 100	

Please return this page with your exam.

1. Given the function

$$\text{ageOf: } People \rightarrow N$$

where *People* is the set of all people living on Earth and *N* is the set of natural numbers. The function associates to each people her/his age. Determine whether the function is
a) injective

b) surjective

2. Given the following bit string (in hexadecimal representation)
`0xff400000`
indicate what number it is
a) if it's an integer in 2's complement representation

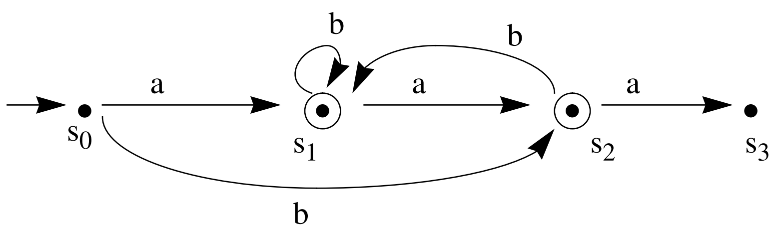
b) if it's a single precision floating point number (IEEE 754 format).

3. Suppose we need a DFA to recognize decimal representations of rational numbers with no repeating decimal patterns (1/3 for instance has a repeating decimal pattern). Find a regular expression for these numbers. Use *d* to represent a decimal digit and the vertical bar for the usual + for regular expressions (since + is now used as the arithmetic plus sign). 1.23, -79.001, and +0.99995 are examples of such numbers.

4. Determine whether the string 1011 belongs to each of the languages described by the following regular expressions:

a) 10^*1
b) $(10)^*(11)^*$
c) $(00)^*1^*(01)^*1$
d) $(00)^+1^*(01)^*1$
e) $0^*(10 + 11)^*$
f) $(1 + 00)(01 + 0)1^*$

5. Given the following FA (over the alphabet A={a, b})



a) indicate whether it is a DFA or an NFA

b) for each of the following strings indicate whether it is accepted or not; in each case also indicate the sequence of states

aaa

aaba

bbbbaba

abbbaab

ε

c) show the transition table of this FA.

6. Construct a finite-state machine that takes an input string consisting of 0's and 1's and outputs the string with every other bit flipped (starting with the second bit). You may use either the Mealy or the Moore model.