V1

May 12, 2000

cs330 - Discrete Structures
Spring 2000

Final Exam
closed books, closed notes

Starts: **10:30 am**   Ends**: 12:30 pm**

Name:_____(please print)

ID:_____

Problem	Max points	Your mark	Comments
1	5		5
2	5		
3	5		
4	10		
5	10		5+5
6	5		
7	10		
8	5		
9	40		8*5
	115		

What happens with this paper (mark one):   **Discard**   **Mail** at this address:

1. Consider the set of all real numbers between zero and one, whose integer part consist of all 3's. Decide whether this set is countable or not. Prove your answer (a correct guess earns you 1/3 of the credit for this problem).

2. Let A be the set of all bit strings, inductively defined by

- Basis: ? ? A
- Induction: if x ? A then $10x01$? A
- Closure: the only elements in A are those described above.

Decide which of the following strings is in A

String	String is in A (T/F)
0	
110	
1001	
110011	
111100	

3. Find a regular expression for the language consisting of strings of odd length over the

alphabet {a, b}.

4. Determine whether the strings in the table belong to any of the languages described by the following regular expressions:

RE	00011 belongs to the language (T/F)	101 belongs to the language (T/F)
10^*1^*		
$(10)^*(1)^*$		
$(00)^*1^*(01)^*1$		
$(00)^*1^*(10)1$		
$0^*(10 + 1)^*$		

5. Assume a FA described by the following state transition table:

State	Input	
	0	1
$? \ ?*?_0$	s_2	s_1
s_1	s_3	s_4
$* \ s_2$	s_2	s_4
s_3	s_3	s_3
s_4	s_3	s_2

a) Draw the state transition diagram for this FA

b) Decide which of the following strings are accepted by this FA

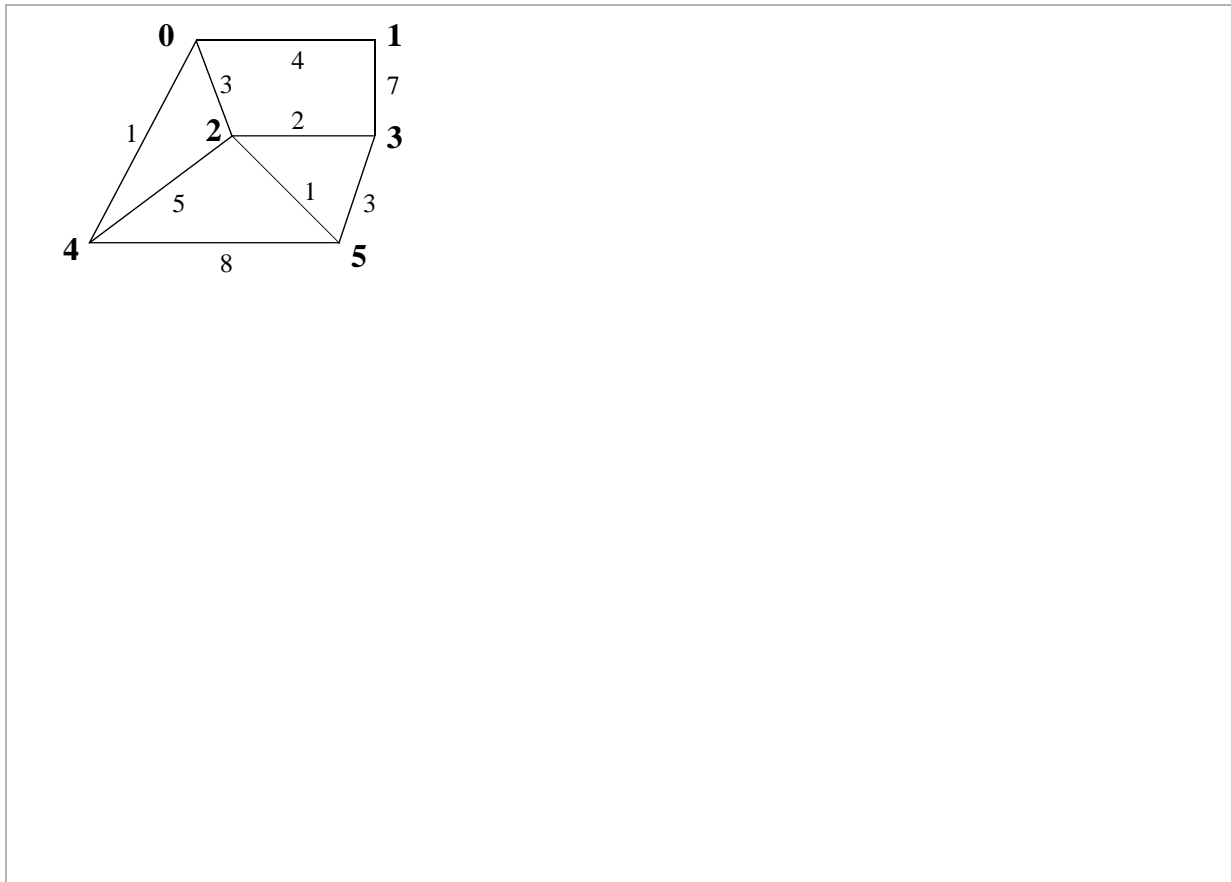| String	Accepted (T/F)
00110	
011	
0000	
11000	
?	

6. Construct a finite-state machine that takes an input string consisting of 0's and 1's and determines whether the last two characters read are the same (output 1 in this case, 0 oth-

erwise). Use the Mealy model.

7. The weighted graph in the figure below shows six cities and the costs of building roads between some of them. Find the lowest cost road system that will connect all cities. Show the steps of your work

8. G is a context free grammar defined by:

$N = \{S, A\}$ $\qquad$ $T = \{0, 1\}$ $\qquad$ Start symbol: S

Productions:

$S \rightarrow 0S$	(1)
$S \rightarrow 1A$	(2)
$S \rightarrow 1$	(3)
$S \rightarrow ?$	(4)
$A \rightarrow 1A$	(5)
$A \rightarrow 1$	(6)

a) what is the language of *G*?

b) find a leftmost derivation of the string 00111. At each step show the production used.
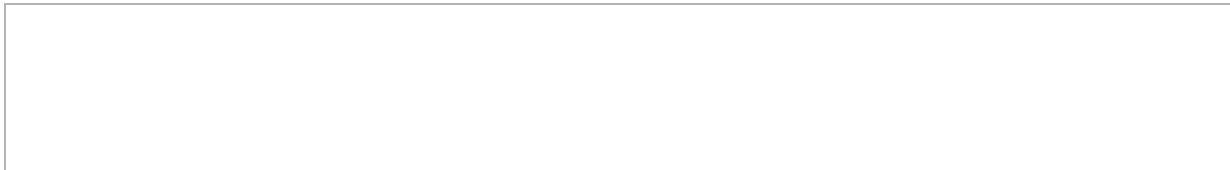
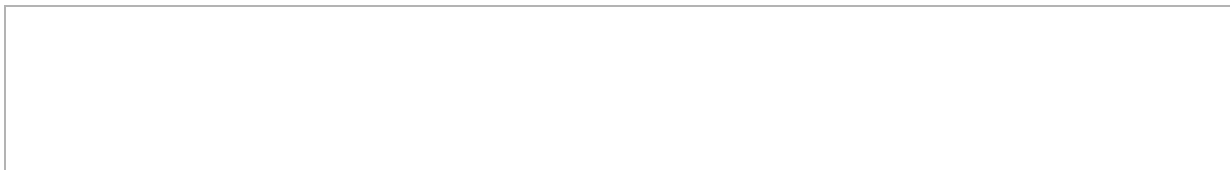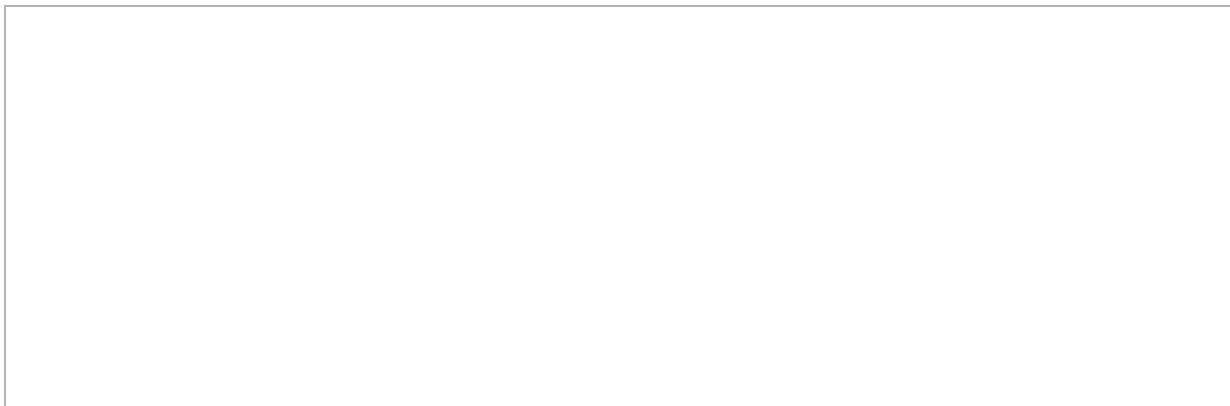**9.** Give a definition for:

a) Function

b) Relation

c) Graph

d) Tree

e) Alphabet

f) Language

g) Regular Language

h) Grammar