V1

cs330 - Discrete Structures
Spring 1998

Midterm Exam
closed books, closed notes

Starts: **9:00 am**   Ends**: 10:15 am**

Name:_____(please print)

ID:_____

Problem	Max points	Your mark	Comments
1	10		10*1
2	10		
3	10		
4	20		5+5+5+5
5	10		5+5
6	10		5+5
7	40		8*5
	110		

Computer Science and Applied Mathematics

1.   Let $A = \{\{a\}, \{\varnothing\}\}$. Mark with true (T) or false (F) each of the following statements:

Statement	T/F
$a \notin A$	
$a \subseteq A$	
$\varnothing \subseteq A$	
$A \subseteq \varnothing$	
$\{\varnothing\} \in A$	

Statement	T/F
$\{a\} \in A$	
$\{a\} \subseteq A$	
$\{\varnothing\} \subseteq A$	
$|A| = 2$	
$\{A\} \subseteq \text{power}(A)$	

2.   A *boolean function* is a function whose domain and codomain is the set $\{0, 1\}$. List all boolean functions of one variable.
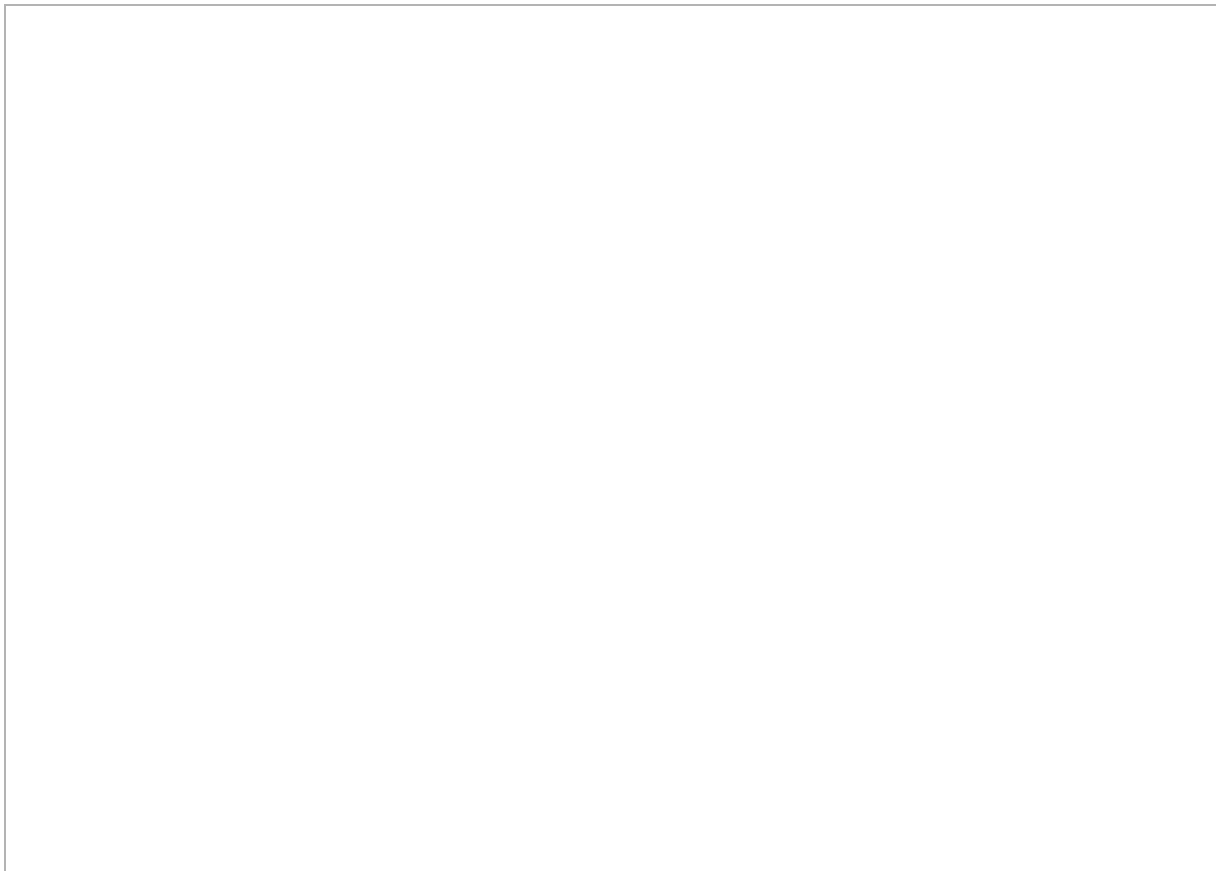
3.   Find $P(P\{\varnothing\}))$, where P denotes the power set of a set.

4.   Let *S* be the set of all three letter strings over the alphabet {0, 1}. A relation *R* on the set *S* is defined as follows: two elements of *S* are related iff they have a common substring of length two. For example `001` and `100` are related because they have in common the substring `00` (of length two)

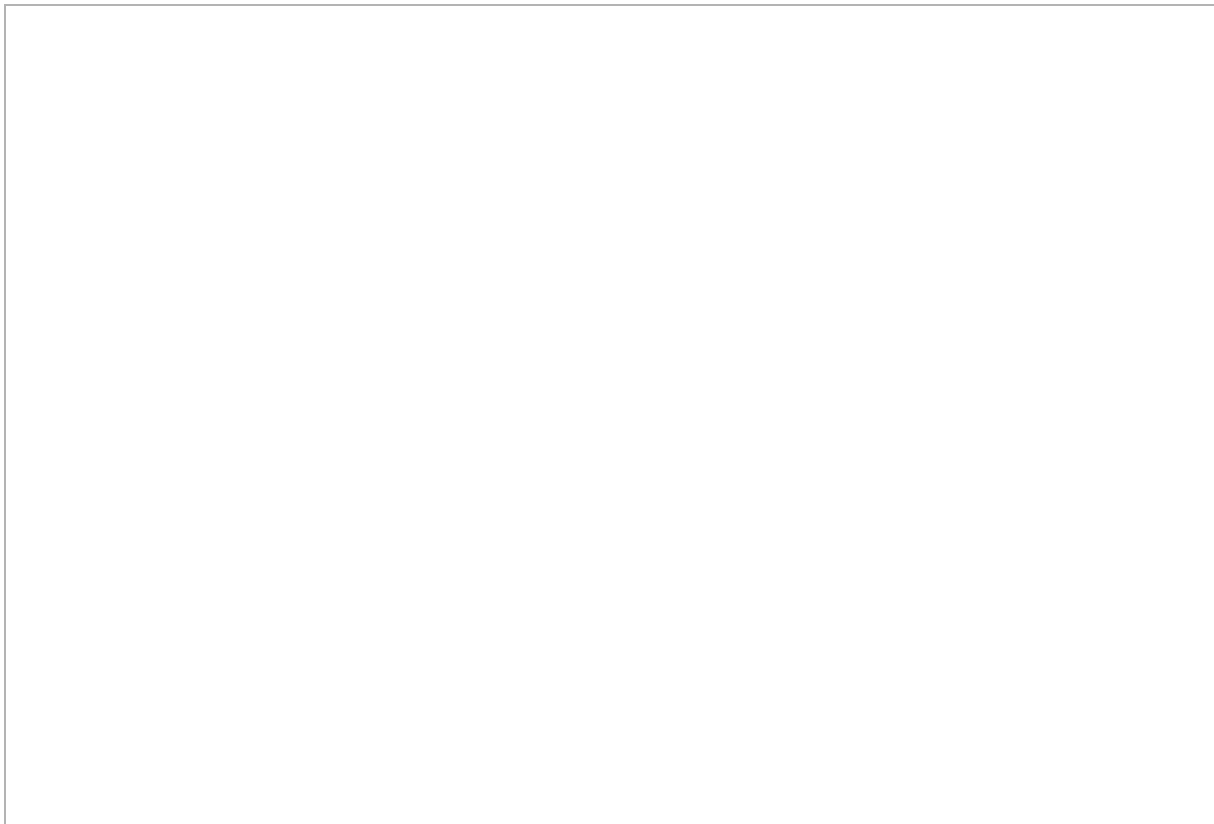a) show the set representation of *R*

b) show the matrix representation of *R*.

c) Show the digraph of R

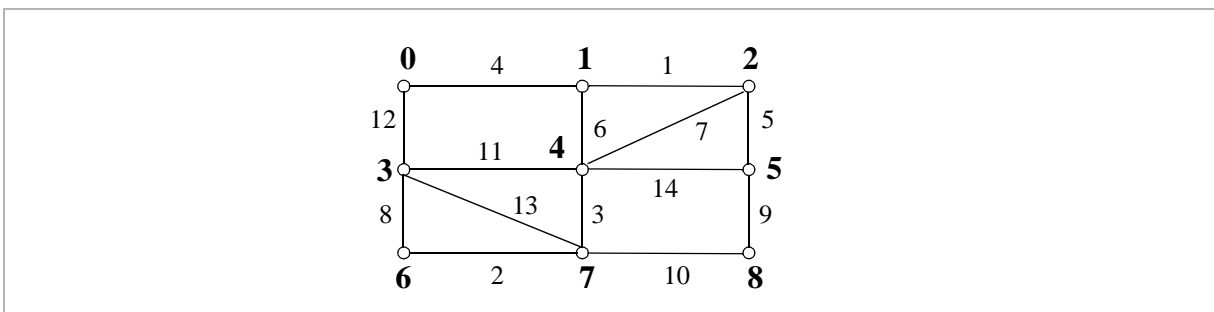d) decide whether R is an equivalence relation or not. If it is, then show the partition it creates on S.

5. This is the postfix (reverse Polish) notation for an algebraic expression:

```
abc/-a2/3+*
```

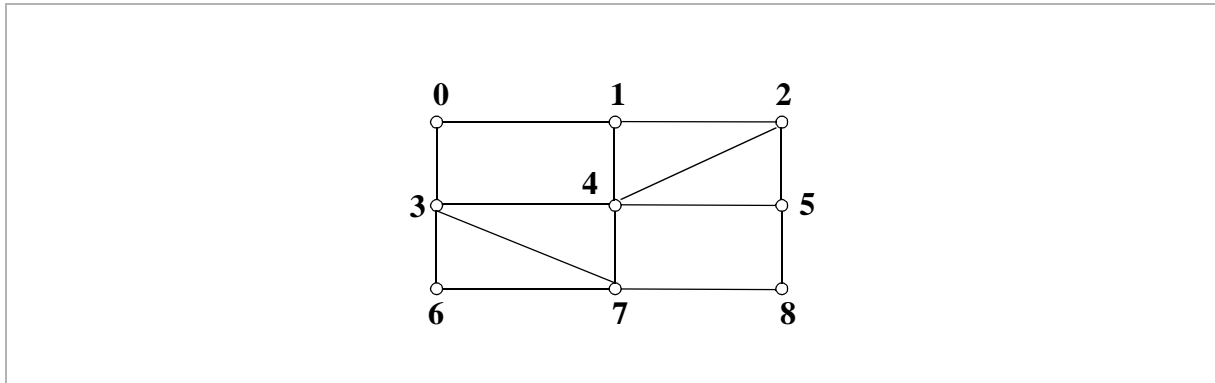a) Show the tree representation of this expression.

b) Show the corresponding algebraic expression

6. Let G be the graph below:

a) Construct a spanning tree for this graph starting with the vertex given by the last digit (rightmost) of your Social Security Number. Use a depth first algorithm with lexico-

graphic ordering when choosing a vertex .

b) Construct a minimum spanning tree for the graph using Prim's algorithm. Use the page attached to this exam to show each step of the process.

7. Give a definition for:

a) Set

b) Cartesian product

c) Relation

d) Function

e) Injective function

f) Graph

g) Euler Path in a graph

h) Spanning tree