June 23, 1997

cs330 - Discrete Structures
Summer 1997

Midterm Exam
closed books, closed notes

V2

Starts: **6:20 pm**
Ends**:** **7:20 pm**

Name:_____(please print)

ID:_____ Section: _____

Problem	Max points	Your mark	Comments
1	10		10*1
2	9		3+2+2+2
3	16		5 + 2 + 2 + 7*1
4	5		3 + 2
5	10		4 + 6
6	15		5*3
7	5		3 + 2
	70		

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
$\{a\} \in A$	
$\{a\} \subseteq A$	
$\{\varnothing\} \subseteq A$	
$A \in A$	
$\{A\} \subseteq \text{power}(A)$	

2. For each integer i, define the set A_i as follows:

if i is odd then $A_i = \{ x \mid x \in Z \text{ and } x \prec -i \text{ or } i \prec x \}$

if i is even then $A_i = \{ x \mid x \in Z \text{ and } -i \prec x \prec i \}$

Describe each of the sets:

a) A_0

b) A_2

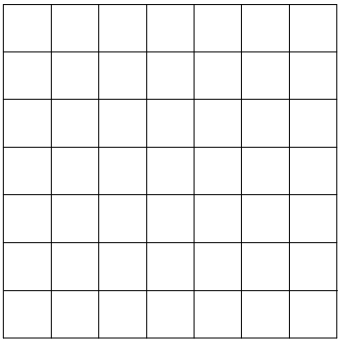
c) A_{-3}

d) Find the union of the sets A_i, $i \in \{0, 2, -3\}$

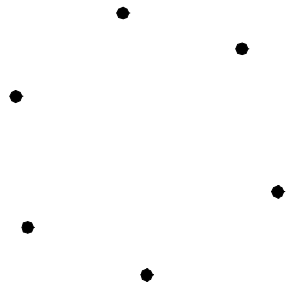
3. Let $S = \{1, 2, 3, 4, 5, 6\}$ and a relation R on S defined as
$a \; R \; b$ if and only if $(a+b) > 5$, $a, b \in S$

a) show the set representation of R

b) show the matrix representation of R. Show the digraph of R



The matrix of R.



The digraph of R

c) mark with true (T) or false (F) the following statements. If your answer is true then give an example

Statement	Your answer	Comments
There is a cycle in the digraph		
There is a path of length 3 in the digraph of R		
There is a sink in the digraph		
The relation is reflexive		
The relation is symmetric		
The relation is transitive		
The digraph is connected		

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

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ab-cd*ef/++a*
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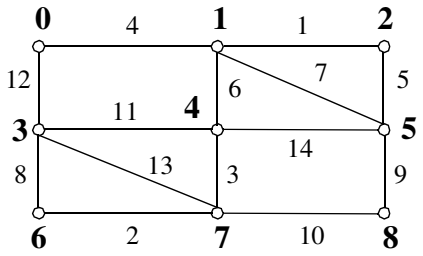
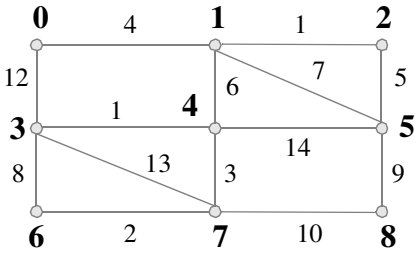
a) Show the tree representation of this expression.

b) Show the corresponding algebraic expression

5. Let G be the graph below:



a) Construct a spanning tree for this graph starting with the vertex given by SSN **mod** 9, where SSN is your Social Security Number. Use a depth first algorithm with lexicographic 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.

6. Give a definition for:

a) set

b) relation

c) Cartesian product

d) graph

e) spanning tree

7. Explain the difference between:

a) an Euler cycle and a Hamiltonian cycle in a connected, undirected graph

b) a set and a list

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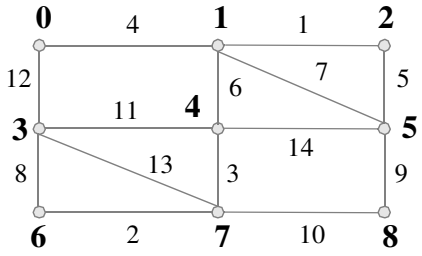
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11 4
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8 13 3 9
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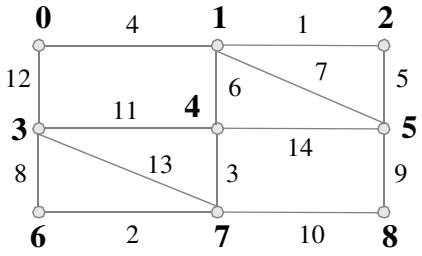
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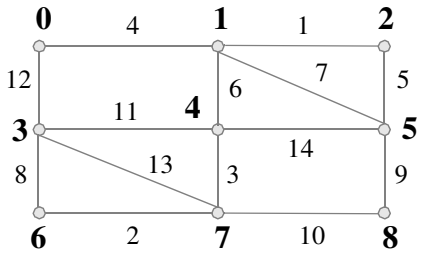
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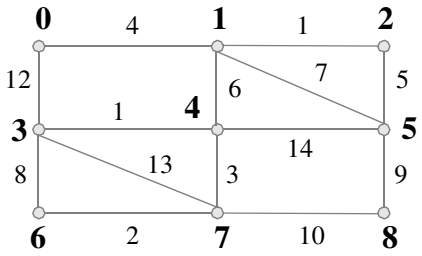
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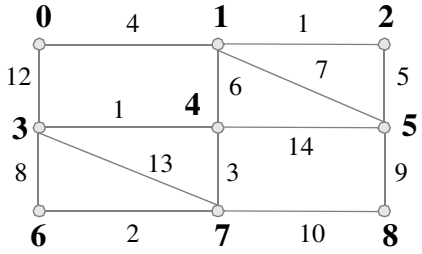
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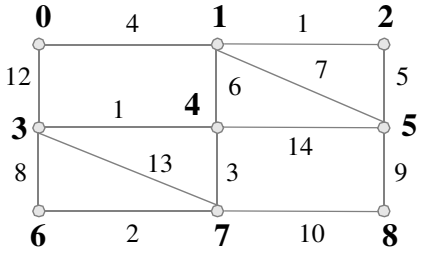
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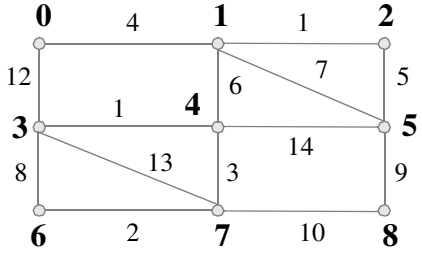
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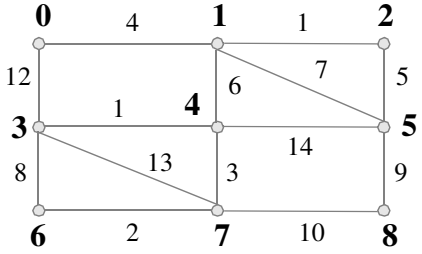
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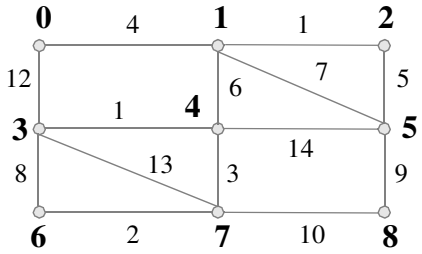
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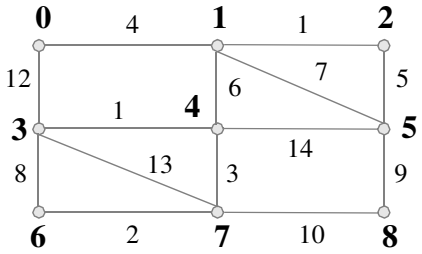
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