**CSC 4500 Assignment 1**

**Personal Note:**

I have a tendency to forget everything I’m doing, my solution is to write down how to do it before I do it, then follow my own little walkthrough for myself. It means all of my homework makes a great study guide for myself.



Cartesian product involves creating tuples of the first set paired with every item of the second set, with the item of the first set appearing first, and iterating through the items of the second set second.

S1 x S2 =

{

(2,2)(2,4),(2,5)(2,8),2,9),

(3,2),(3,4),(3,5),(3,8),(3,9),

(5,2),(5,4),(5,5),(5,8),(5,9),

(7,2),(7,4),(7,5)(7,8),(7,9),

}

S2 x S1 =

{

(2,2)(2,3)(2,5),(2,7)   
(4,2)(4,3)(4,5)(4,7)

(5,2)(5,3)(5,5)(5,7)

(8,2)(8,3),(8,5),(8,7)

(9,2),(9,3),(9,5),(9,7)

}



U means union(everything from both sets)

Upside down U thing means intersection (only what the sets have in common)

S and T have {2,6,8} in common

All distinct elements from both sets is {2,3,5,6,8}

The little bracket things || mean cardinality (number of elements in each set.

So counting using our eyes, there are 3 in the intersection and 5 in the union, meaning the answer is 8.



Graphs are composed of vertices and edges, edges go from vertex to vertex. So just draw the vertexes first, then create the edges between them. I am assuming this is a directed graph, because otherwise drawing edges without arrows makes it look weird.  
  
A drawing of a person

Description automatically generated

Looks like if you end up at v3 you get stuck there, that’s kind of funny.



Grammar is made up of G = (V,T,S,P) = (Variables, Terminal Symbols, Start, Productions)

V = {S}

T = {a}

Start = S

Productions =

S -> aSa

S -> [EMPTY STRING SYMBOL HERE HOW DO I MAKE IT IN WORD]   
Applying the productions ensures that only an even number of a is created, as it always adds 2a to the existing symbols

A white background with black text

Description automatically generated  
a.)  
Variables S,A,B

Start = S

Productions =

Terminal Symbols = {a,b}  
S -> aaaA | aaaB

A -> aA | bA | [EMPTY STRING SYMBOL HERE]

B -> aB | bB | [EMPTY STRING SYMBOL HERE]

b.)  
Variables S,T

Start = S

Terminal Symbols = {a,b}

Productions =

S-> aTb

T -> aT | bT | [EMPTY STRING SYMBOL HERE]



A DFA is given by M = (Internal States, Input Alphabet, Transition Function, Initial State, Final State)

A drawing of a bear

Description automatically generated

I don’t know how to make the transition function symbol show up, so just sorta assume it is here for each input:

INTERNAL STATES: q0,q1

INPUT ALPHABET: {a,b}

TRANSITION FUNCTION:

(q0,a) = q1

(q0,b) = q0

(q1,a) = q0

(q1,b) = q1

INITIAL STATE: q0

FINAL STATE: q1

  
A diagram with red lines and numbers

Description automatically generated with medium confidence

INTERNAL STATES: q0,q1,q2,q3,q4,q5,q6,q7

INPUT ALPHABET: {a,b}

TRANSITION FUNCTION:

(q0,a) = q1

(q0,b) = q7

(q1,a) = q7

(q1,b) = q2

(q2,a) = q7

(q2,b) = q3

(q3,a) = q7

(q3,b) = q4

(q4,a) = q5

(q4,b) = q4

(q5,a) = q6

(q5,b) = q7

(q6,a) = q6

(q6,b) = q7

(q7,a) = q7

(q7,b) = q7

INITIAL STATE: q0

FINAL STATE: q6