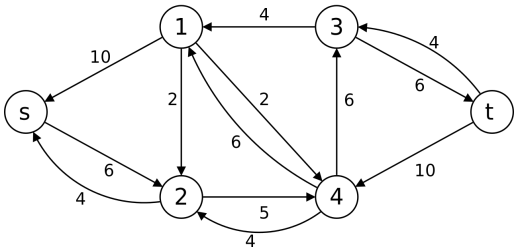
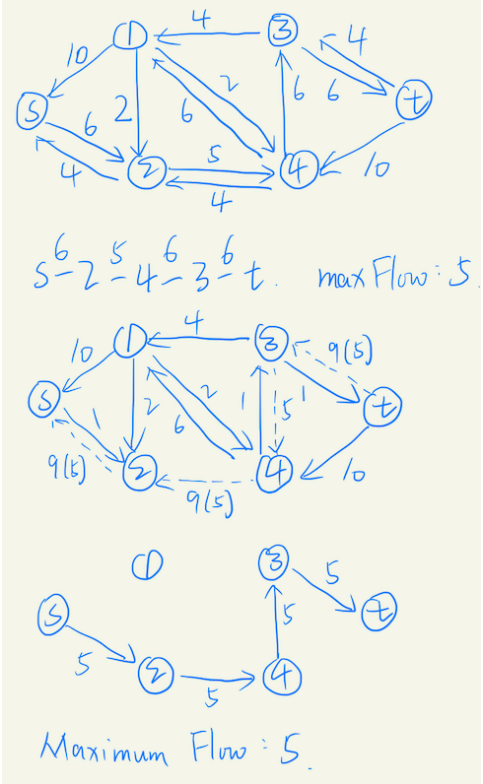
Data Structures and Algorithms
INFO 6205
Homework 12

1. Consider Capacity, Flow, Residual Capacity, and Augmented Path in the following Ford-Fulkerson graph:



a) What is the MaximumFlow in the graph, show ALL augmented paths step-by-step



https://algorithms.tutorialhorizon.com/max-flow-problem-ford-fulkerson-algorithm/

b) What is the Time complexity and Space of the algorithm?

Time complexity is O(max_flow * E). E: number of edges.
Space complexity is O(V^2).

c) Write the Java code for the algorithm?

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Ford-Fulkerson Algorithm
1) Start with initial flow as 0.
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2) While there is a augmenting path from source to sink.
           Add this path-flow to flow.
3) Return flow.
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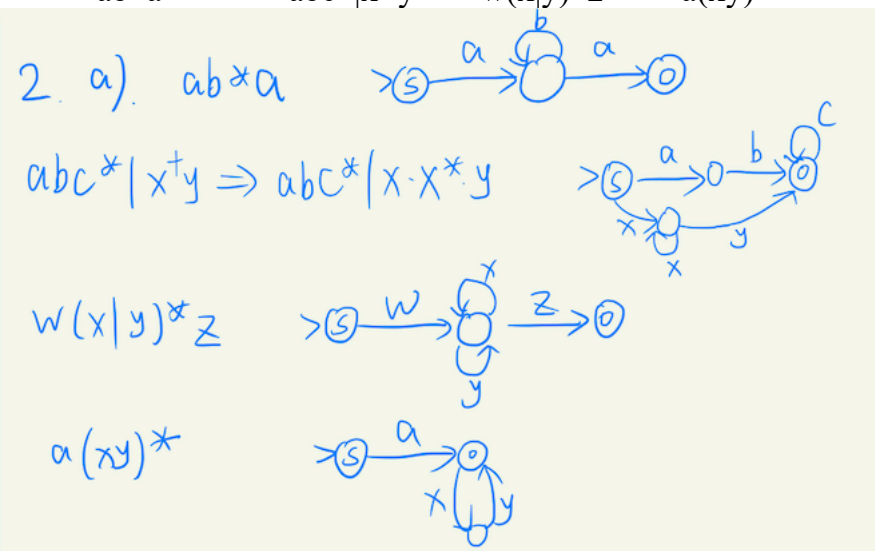
2. For the following Regular Expression (RE) Input Strings

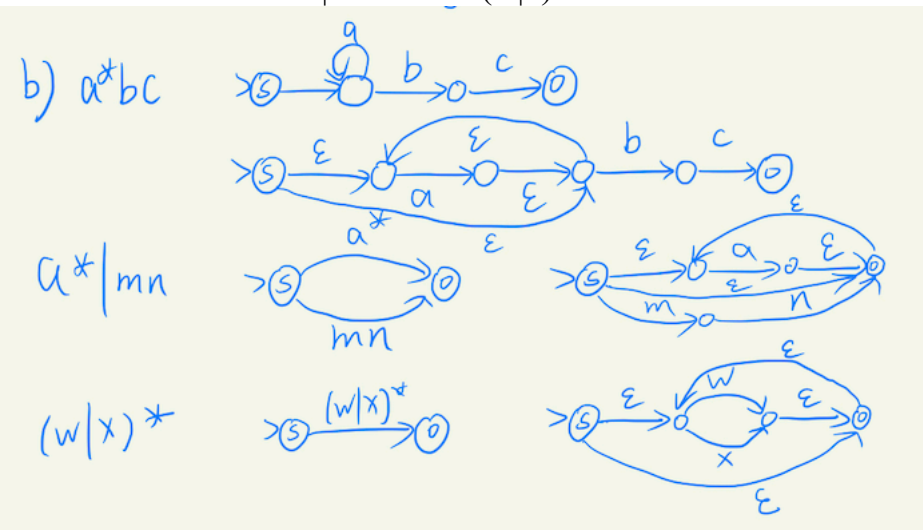
a) Convert each RE to DFA

ab*a abc*|x+y w(x|y)*z a(xy)*

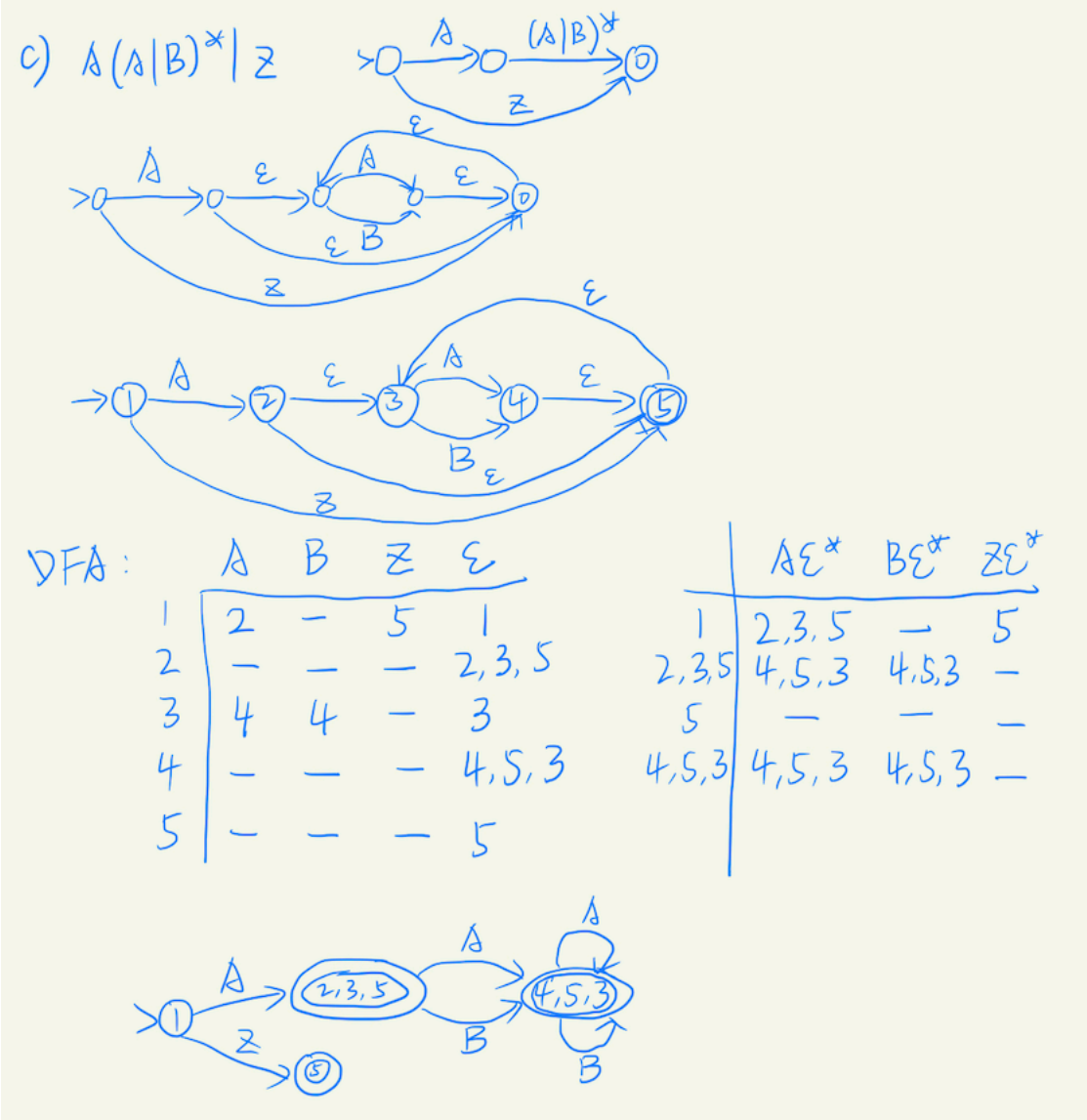


b) convert RE to NFA

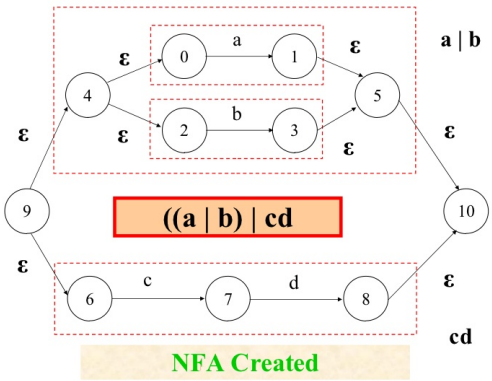
a*bc a*|mn (w|x)*



b) Convert A(A|B)*|Z to NFA and then to DFA



d) convert the following NFA to DFA and then to RE



3. Describe the following:

NP-Hard, provide three examples

P, provide examples
NP
NP-Complete
Satisfiability Model, give example

NP-Hard: SAT (Boolean satisfiability problem), Knapsack problem, Hamiltonian path problem
P: linear search-n, binary search-logn, insertion sort-n^2, mergesort-logn
sorting of array elements, check whether a string is palindrome or not
NP: factorisation, TSP(Traveling Salesman Problem), Clique problem
NP-Complete: SAT (Boolean satisfiability problem), Knapsack problem, Hamiltonian path problem
NP-complete problems (proof omitted): SAT, Partition, and 3-Partition.
Satisfiability Model: SAT (Boolean satisfiability problem)