

Acceptance Problem

Does a DFA B accept string w ?

$$A_{DFA} = \left\{ \langle B, w \rangle \mid \text{DFA } B \text{ accepts input } w \right\}$$

Show A_{DFA} is decidable by constructing a TM, M that decides A_{DFA} .

M : on input $\langle B, w \rangle$ where B is a DFA and w is a string.

1. simulate B on input w .
2. IF simulation ends in accept state, accept. Otherwise reject.

1.a. check input

1.b.



```
boolean DFA_accept(DFA B,  
String w){  
    return simulate(B, w);  
}
```

}

$$A_{\text{NFA}} = \{ \langle B, w \rangle \mid B \text{ is an NFA that accepts string } w \}$$

A_{NFA} is decidable

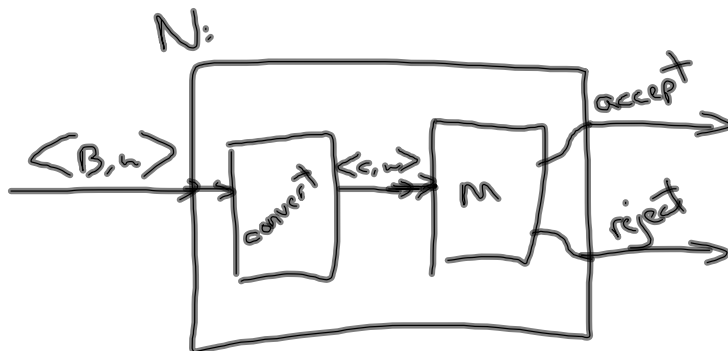
N : on input $\langle B, w \rangle$ where B is an NFA and w is a string.

1. convert NFA B to equiv. DFA C .
2. run TM M on $\langle C, w \rangle$
3. IF M accepts, accept
Otherwise, reject.

```

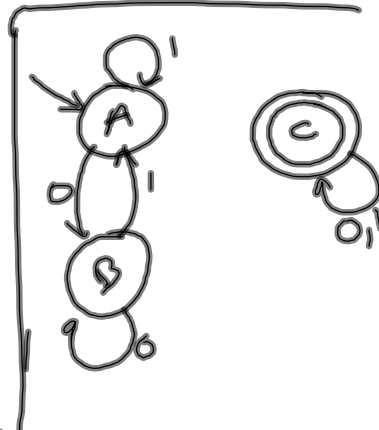
boolean NFA-accept(NFA B,
String w) {
    DFA C = nfa2dfa(B);
    return DFA-accept(C, w);
}

```



Emptiness Testing

$$E_{\text{DFA}} = \{ \langle A \rangle \mid A \text{ is a DFA and } L(A) = \emptyset \}$$



E_{DFA} is decidable

construct TM T

T : on input $\langle A \rangle$ where A is a DFA

1. mark the first state
 2. repeat 3 until no new states are marked
 3. mark any state that has a transition from a marked state
 4. If no accept states are marked, accept
Otherwise, reject
1. simulate all strings up to length p
 $p = |Q|$
 2. if any string are accepted, reject
Otherwise, accept