

### **Preet Kanwal**

Department of Computer Science & Engineering



## Unit 3

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## **Unit 3 - CYK Algorithm**



## **Example 1:**

Parse the string abba using CYK algorithm,

#### Grammar:

 $S \rightarrow aSb \mid bSa \mid SS \mid \lambda$ 

## **Solution:**

Conversion to CNF

$$S \rightarrow AB \mid BA \mid AC \mid BD \mid SS \mid \lambda$$

 $A \rightarrow a$ 

 $B \rightarrow b$ 

C -> SB

D -> SA

## **Unit 3 - CYK Algorithm**



## **Example 1:**

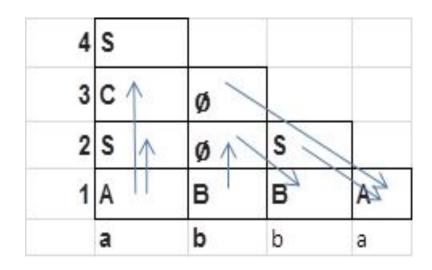
Parse the string abba using CYK algorithm

## Grammar:

,

 $S \rightarrow aSb \mid bSa \mid SS \mid \lambda$ 

## **Solution:**



1) Strings of the length 1 can be generated by

 $A \rightarrow a$ 

 $B \rightarrow b$ 

2) Strings of the length 2 can be generated by

For AB

 $S \rightarrow AB$ 

For BA

 $S \rightarrow BA$ 

For BB it is Ø

3) Strings of the length 3 can be generated by

a) 
$$A \cdot \emptyset \cup S \cdot B = \emptyset \cdot SB$$
 (SB is generated by C)  $C \rightarrow SB$ 

b) B.S  $\cup \varnothing$ .A

BS is not generated by any rule

4) Strings of the length 4 can be generated by

$$A \cdot \emptyset \cup SS \cup CA$$

The given string belongs to the grammar

## **Unit 3 - CYK Algorithm**



## **Example 1:**

Parse the string aabba using CYK algorithm,

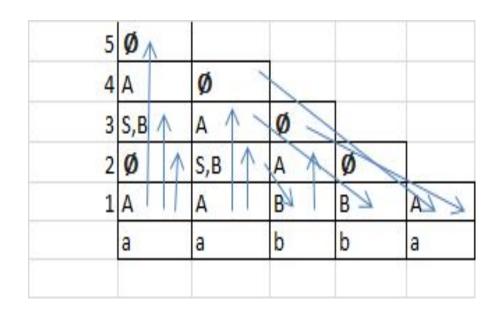
#### Grammar:

$$S \rightarrow AB$$

$$A \rightarrow BB \mid a$$

$$B \rightarrow AB \mid b$$

## **Solution:**



#### Length 3:

- 1)  $A(S, B) \cup \varnothing .B (S \rightarrow AB, B \rightarrow AB)$  $AS, AB, \varnothing$
- **2)** AA  $\cup$  (S,B) (B) (A -> BB) AA  $\cup$  SB,BB
- 3) A.ø

#### Length 4:

- 1)  $AA \cup \varnothing A \cup (S,B) (B)$   $AA \cup \varnothing \cup SB \cup BB$  $(A \rightarrow BB)$
- 2) A. Ø ∪ (S,B) Ø ∪ AA Ø ∪ Ø ∪ AA =Ø

#### Length 5:

$$A \varnothing \cup \varnothing . \varnothing \cup (S,B) \varnothing \cup AA$$

$$= \varnothing$$

The string does not belong to grammar

## **Unit 3 - CYK Algorithm**



#### **Example 1:**

Parse the string baaa using CYK algorithm,

#### Grammar:

$$\mathbf{S} \rightarrow \mathbf{AA} \mid \mathbf{BC}$$

$$A \rightarrow BA \mid a$$

$$B \rightarrow CC \mid b$$

$$C \rightarrow AB \mid a$$

### **Solution:**

4	S,A,C			
3	Ø	S,A,C		
2	A,S ∧	В 🦳	В	
1	В	A,C	A,C	A,C
	b	а	а	а

#### Length 3:

2) (A,C) (B) 
$$\cup$$
 B(A,C)  
AB  $\cup$  CB  $\cup$  BA  $\cup$  BC  
S  $\rightarrow$  AB | BC A  $\rightarrow$  BA  
C  $\rightarrow$  AB

#### Length 4:

$$B(S,A,C) \cup (A,S) B \cup \varnothing (A,C)$$
=  $BS \cup BA \cup BC \cup AB,SB$ 
 $A \rightarrow BA$ 
 $S \rightarrow BC$ 
 $S \rightarrow AB$ 
 $C \rightarrow AB$ 

The string baaa belongs to the grammar



## **THANK YOU**

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