

Name: \_\_\_\_\_

## CSCI 380: Activity 6

### Transforming Grammars and Parsing

Team Roles	Team Member
<b>Facilitator:</b> reads the questions aloud, keeps track of time and makes sure everyone contributes appropriately.	
<b>Spokesperson:</b> talks to the instructor and other teams.	
<b>Quality Control:</b> records all answers & questions, and provides team reflection to team & instructor.	
<b>Process Analyst:</b> considers how the team could work and learn more effectively.	

#### Note

If you have 3 people, combine Facilitator & Process Analyst.

#### Learning Objectives

1. Transform grammars into a standard form
2. Determine membership of words in grammars
3. Practice clear communication



In this Activity, you will find two [Modules](#) and one [Reflection](#) section.

start time:
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**Model I. Transforming CFG (15 min)**

Recall the steps for converting a context-free grammar to Chomsky Normal Form:

1. Remove  $\lambda$  productions
2. Remove unit productions
3. Remove useless productions
4. Create productions for single terminal symbols
5. Replace long productions with shorter until right-hand side is length 2

**Critical Thinking Questions**

$$S \rightarrow TT \mid U$$

$$T \rightarrow aT \mid Ta \mid b$$

$$U \rightarrow aUaa \mid b$$

$$Q \rightarrow \lambda$$

$$P \rightarrow QU$$

1. Convert the above grammar into Chomsky Normal Form. Show all your work.

**STOP**

Wait for all teams to complete this model. The spokesperson will be reporting out to the rest of the class.

start time:
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**Model II. CYK Parsing (20 min)**

Recall that  $w = a_1 a_2 \cdots a_n$

We define substrings as  $w_{ij} = a_i \cdots a_j$

For a given grammar  $G$  we can determine for all substrings  $V_{ij} = \{A \in V : A \xRightarrow{*} w_{ij}\}$

This means  $w \in L(G)$  iff  $S \in V_{1n}$ .



Determine if the following words can be generated from the grammar below by using the CYK algorithm.

$$S \rightarrow AB \mid BC$$

$$A \rightarrow BA \mid a$$

$$B \rightarrow CC \mid b$$

$$C \rightarrow AB \mid a$$

1. *aaab*

1. *baaba*

1. *abbabb*

**Looking Back - Group Reflection**

Review the job descriptions on your role card. Evaluate privately on how well you performed in your role. Provide the following using the **SII framework**:

**S** – *Strength* (Also what specifically did you do that would indicate that it was a strength)

**I** – *Improvement Area*

**I** – *Insight* concerning either the process or the content of the activity

**Facilitator**

List below how long each Model took your group:

- Model I:
  - Model II:
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**Process Analyst**

Give feedback to each of your other team members with a **strength** that you observed, either in their role or their process skills.

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**Quality Control**

Ensure the answers for your team are approved by all team members before handing them in.

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**Spokesperson**

Gather up the name cards and any other materials and give them to Dr. Goadrich.