137	
Familian E	Student ID 30601
Date 2014	
	Student Name S. F. S. Ricky

TUTORIAL SESSION 12:

Normal Form: GNF

Concept Building

Greibach Normal Form (GNF)

tile a specific type of context-free grammar that simplifies the structure of production rules to facilitate parsing and theoretical analysis. It is named after Sheila Greibach, an American computer scientist who made significant

Characteristics of Grelbach Normal Form

A context-free grammar is in Greibach Normal Form if every production rule adheres to the following form:

A commo

Here, A is a non-terminal symbol, 'a' is a terminal symbol, and α (alpha) is a (possibly empty) string of nonterminal symbols. This form ensures that each production rule begins with a terminal symbol followed by zero

importance of Greibach Normal Form

Algorithmic Parsing: GNF is particularly useful for constructing top-down parsers, such as recursive descent parsers, because it guarantees that each production begins with a terminal symbol, making it easier to decide which rule to apply based on the next input symbol.

Theoretical Analysis: GNF simplifies the analysis of context-free grammars by providing a uniform structure for production rules. This uniformity aids in proving properties about languages and grammars, such as closure properties and decidability.

Equivalence to Other Forms: Any context-free grammar can be converted to an equivalent GNF grammar that generates the same language. This conversion preserves the language while restructuring the grammar for easier parsing.

Steps to Convert a Context-Free Grammar to GNF

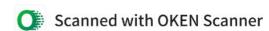
Converting a context-free grammar to GNF involves several steps, often requiring intermediate transformations and the introduction of new non-terminals:

Remove Left Recursion: finaure that the grammar is free from left recursion, as left-recursive rules cannot be converted directly to GNF

Eliminate Non-Productive and Unreachable Symbols: Remove any non-productive symbols (symbols that do not derive any terminal strings) and unreachable symbols (symbols that cannot be reached from the start symbol)

Ensure Proper Ordering: Ensure that the non-terminals in the grammar are ordered such that when converting each rule to GNF, the right-hand side contains only non-terminals that have already been Moressed

Course Title	AUTOMATA THEORY AND FORMAL LANGAUGES	
	TO COMMIN THE DRIT AND TORMAL LANGAUGES	ACADEMIC YEAR: 2023-24
Course Code(s)	22C52002A	132
121	E4 C34 BIT W	Page 132 of 261



134	12			The state of the s
Experiment #	3 1 1 1 2 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2	distr	Student ID	30609
Date	2019	1/0/2	Student Name	S.R.S. Road

Pre-Tutorial (To be completed by student before attending tutorial session)

1. Convert the given CFG to GNF:

Solution:

$$S \rightarrow AB, A \rightarrow BS \mid b, B \rightarrow SA \mid a$$

un No epsilon transitions

(14) Sand are GNF

$$S \rightarrow AB$$
 $S \rightarrow bB$ (4) GNF
 $A \rightarrow BS$ $A \rightarrow aS$ $S \rightarrow AB$
 $B \rightarrow SA$ $B \rightarrow Sb$ $A \rightarrow ABB$

I should know that on - 1

$$A \rightarrow B \rightarrow SB$$

$$B \rightarrow BA \mid aS$$

$$B \rightarrow SB \mid b$$

Course Title	AUTOMATA THEORY AND FORMAL LANGAUGES	ACADEMIC YEAR: 2023-24
1 - C		134
Course Code(s)	22CS2002A	Page 134 of 261

135		Student ID	G0609-
Experiment #	13	Student Name	
Date	0019		

2.Transform the following grammar into GNF. S→AA | 0, A→SS | 1 Solution:

Simplification

No Epsilon

- a) Nounit transition
- 3) Useless transitions

Final:

Course Title	AUTOMATA THEORY AND FORMAL LANGAUGES	- 80 8 15 Sept. 14
	THEORY AND FORMAL LANGAUGES	ACADEMIC YEAR: 2023-
Course Code(s)	22C52002A	13
		Page 135 of 26

136 ment # / 2	Student ID	P 1 0 8a
Openment # 20/9	Student Name	straining profession in the second se
Date	erital established to the second	

3.Find GNF equivalent for the given CFG:

Solution:

- 1) Epsilon transitions No epsilon
- No Unit transition
- 3) Usessless transitions $S \rightarrow CA \qquad B \rightarrow 'b' \qquad C \rightarrow 'b' \qquad A \rightarrow 'a'$ $\rightarrow 'ba'$

Course Title	AUTOMATA THEORY AND FORMAL LANGAUGES	ACADEMIC YEAR: 2023-24
		136
Course Code(s)	22CS2002A	Page 136 of 261

		T Student 10 300.7
137	The state of the s	Student Name S. P. Se
Experiment #	12	100
Date	2017	2

IN-TUTORIAL (To be carried out in presence of faculty in classroom)

1.Convert the following grammar into Greibach Normal Form:

vert the following gramma. E
$$\rightarrow$$
 E + T | T, T \rightarrow T*F | F, F \rightarrow (E) | 3

Solution:

(ii) Remove useless transition.

No useless

Course Title	AUTOMATA THEORY AND FORMAL LANGAUGES	ACADEMIC YEAR:
	ONMAL LANGAUGES	ACADEMIC TO
Course Code(s)	22C52002A	13
Course cope(s)	LLUJLUULK .	Page 1

Experiment # / 2	Student ID . Student Name	30601 Sept 5 Rodd
Date	Standin Name	S.B.S. Reddy

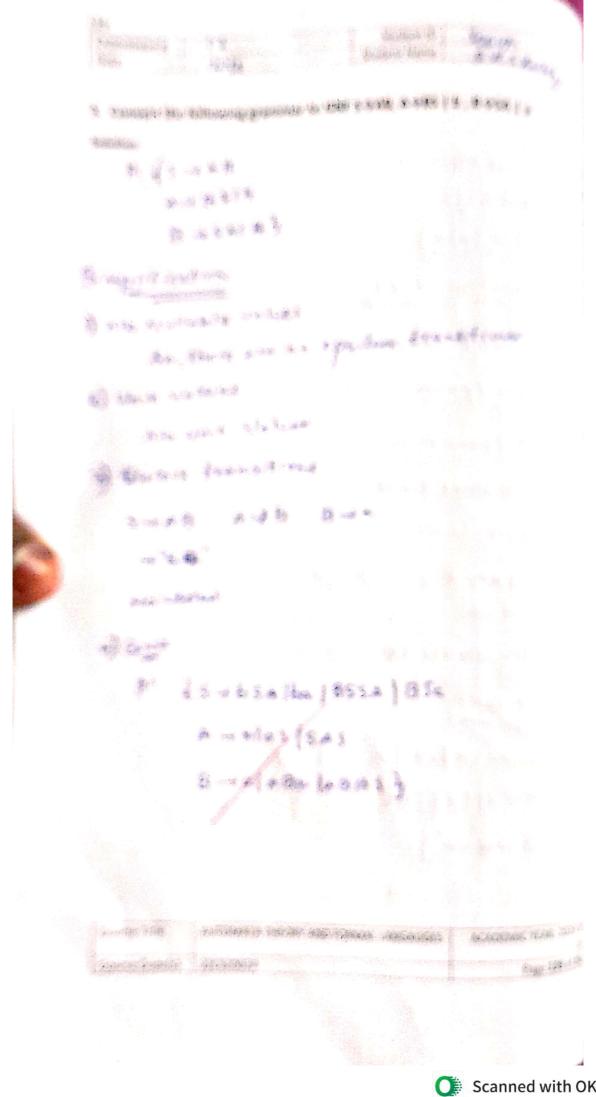
2.Convert the following CFG to GNF S \rightarrow AB, A \rightarrow BS | a, B \rightarrow SA | b. solution:

- i. No Epsilon transitions
- (ii) Unit transitions

 : No Unit transitions
- iii) Remove Useless transitions

: No useless transitioner

C		indicates we in year to work to a particular and another to a particular particular particular particular particular and a particular particula
Course Title	AUTOMATA THEORY AND FORMAL LANGAUGES	ACADEMIC YEAR: 2023-24
		138
Course Code(s)	22CS2002A	Page 138 of 261(



149 more II	Student ID	20602
Copenment 3019	Mudern Name	S.P.S.P

4. A grammar G is defined with rules $S \rightarrow XA \mid BB, B \rightarrow b \mid SB, X \rightarrow b, A \rightarrow a$. Write the productions obtained after normalized GNF of G.

solution:

Simplification

2) Unit Values No Unit Value

FINAL GIMP

p1: { 50 + 15 A + 10 + 13 50 + 13 50 S-) balb DISBB. B-16/60B/6BB/23BBB x-1b A-103.

Course Title	AUTOMATA THEORY AND FORMAL LANGAUGES	ACADEMIC YEAR: 2023-24
		140
Course Code(s)	22CS2002A	Page 140 of 261

141	and the second	lent ID 3-4
Experiment #	Student Student	Name C. D. C. D.
Date	2019	5 KS Redd

Post-Tutorial (To be carried out by student after attending tutorial session)

1. Convert the following CFG to GNF: $S \rightarrow AB$, $A \rightarrow BSB$, $A \rightarrow a$, $B \rightarrow b$ Solution:

P:
$$\{S \rightarrow AB$$

 $A \rightarrow BS B$
 $A \rightarrow a$
 $B \rightarrow b$

Simplification

- 1) Epsilon transition

 No nullable values.

 2) Unit productions No Unit production

Course Title	AUTOMATA THEORY AND FORMAL LANGAUGES	ACADEMIC YEAR: 2023
Course Code(s)	22CS2002A	Page 141 of

142	ant II		
	periment #	Student ID	A STATE OF THE PARTY OF THE PAR
00	(0)	Student Name	S.R.S. Reddy

2. Convert the following CFG to GNF: $S \rightarrow A$, $A \rightarrow aBa \mid a, B \rightarrow bAb \mid b$

solution:

3. Write the steps for removing null productions and unreachable symbols? Explain with an example of your own.

Solution:

- . Identify nullable hon-terminals.
- · For each rullable non-terminal, add ne coproductions
- · Remove the null productions,
- 2) Remove Un reachable Symbols

·Identify reachable symbols by starting form the Start Symbol and marking Symbols used in productions

The state of the s		
Course Title	AUTOMATA THEORY AND FORMAL LANGAUGES	ACADEMIC YEAR: 2023-24
The state of the s	AOTOMATA TILEOTT	142
Course Code(s)	2200200	Page 142 of 261
TOURS COURTS	22CS2002A	

The property of the state of th	the contract of the second of	Student ID 36	60%
M formand M	A Samuel Commence		60%
Sales.	20/9	Student Name	3.00

Viva Questions

1. What is Greibach Normal Form (GNI) in the context of context-free grammars, and what are a company of the

ANTHON

ONE is a special form of context -free. grammars where every production rule Gloris with a terminal followed by zero El more terminals

2. What are some practical applications of Greibach Normal Form in computer science?

1- Jop Down parsing 2 Theoritical Anglysis 3. Proving Garammer Correctness

between the second particular state		221.74
Course Tale	AUTOMATA THEORY AND FORMAL LANGAUGES	ACADEMIC YEAR: 2023-24
Laurie Cade(s)	22C52002A	Page 143 of 261

144		·	
Experiment #)	Student ID	30 109
Date	20/9	Student Name	S.R.S.R.
			9,

3. Can you describe the process of converting a context-free grammar into Greibach Normal Form? Answer:

Yo convert a CNF to GNE

- 1) Start by removing left recursion
- a) ensure every production starts with a. ferminal

J-) Ty

3) Replacing non-terminals with proper ferminal. firstrole

(For Evaluator's use only)

Evaluator's Observation
Marks Secured: 50 out of 50
Full Name of the Evaluator:
Signature of the Evaluator Date of
Evaluation:

Course Title	AUTOMATA THEORY AND FORMAL LANGAUGES	ACADEMIC YEAR: 2023-24
3		144
Course Code(s)	22CS2002A	Page 144 of 261