**UNIT-III**

**SCENARIO QUESTIONS**

1. Consider the following grammar

S → NP / VP

N → boy | school

NP → the N | NP that VP

VI → went AD | reached AD

AD → to | by

VT → drives | walks

VP → VT | VI NP

Where NP is Noun Phrase, VP is Verb Phrase, VT- Verb Terminal, VI is Verb Intermediate, AD is Adverb, N is Noun

a. Optimize the grammar

b. Convert the given grammar to Chomsky Normal Form (CNF)

c. Convert the given grammar to Greibach Normal Form (GNF)

d. Construct PDA from CFG

1. Consider the following grammar

S → NP VP

S → Aux NP VP

S → VP

NP → Det NOM

NOM → Noun

NOM → Noun NOM

VP → Verb

VP → Verb NP

Det → that | this | a | the

Noun → book | flight | meal | man

Verb → book | include | read

Aux → does

a. List the terminal and non-terminal symbols.

b. Simplify the grammar.

c. Convert the above CFG to Chomsky Normal Form (CNF).

d. Convert the above CFG to Greibach Normal Form (GNF).

e. Convert CFG to PDA.

1. Consider the following grammar



Construct PDA for above Grammar

1. Consider the following CFG for any programming construct

BLOCK → STMT | {STMTS}

STMTS → ε | STMT STMTS

STMT → EXPR; | if (EXPR) BLOCK | while (EXPR) BLOCK | do

BLOCK while (EXPR); | BLOCK

EXPR → identifier | constant | EXPR + EXPR | EXPR – EXPR |

EXPR \* EXPR| EXPR/EXPR

1. Remove the useless production

2. Remove the null production

3. Remove the unit production

4. Convert to GNF

5. Convert to PDA.

1. A PDA is defined as M={ Q,Σ,Γ,δ,q\_(0,) Z\_(0,) F} and its definition is as following: Q={ a ,b} , Σ={x,y}, Γ={ Z\_0,S}, δ is given as follows∶

1.δ (a, ϵ, ϵ) = (a,Z\_0 )

2.δ (a, x, Z\_0 )=(a,SZ\_0 )

3.δ (a,x,S)=(a,SS)

4.δ (a,y,S)=(a,S)

5.δ (a,ϵ ,S)=(b,ϵ)

6.δ (b,ϵ,S)=(b,ϵ)

7.δ (b,y,S)=(p,SS)

8.δ (b,y,Z\_0 )=(b,ϵ)

a) Describe the working of the PDA

b) Show the ID moves for the input xyyxxyyxy

c) Find out the any of the possible input at when the PDA enter state b for the first time with all inputs consumed and the stack has the contents as SSZ\_0 i.e., what is (b,ϵ,SSZ\_0 )⊢ ?

(d) Convert the above PDA to CFG

1. Use the Pumping Lemma to show that the following languages are not context-free.

L= { anbmcndm|n,m>0}

1. Pushdown automaton A is specified by

A = ({q0, q1}, {a, b}, {Z, X}, δ, q0, Z, ∅), where δ contains the

following transitions:

(q0, a, Z) → (q0, λ)

(q0, a, Z) → (q0, XZ)

(q0, a, X) → (q0, XX)

(q0, b, X) → (q1, λ)

(q1, b, X) → (q1, λ)

(q1, a, Z) → (q0, Z).

1. Find the Context Free Grammar (5)
2. Find whether the CFG consisting of Useless symbols, Unit

Productions, epsilon production, reduce if required. (15)

1. Find the Language of a PDA (5)
2. Consider the HTML table cell tag definition <title>cell content here</title>. Construct a push down automata to check the balancing of<title> and </title> tags i.e., the number of <td> tags and </td> tags should be equal. Order need not considered. The automation has to check the balance in count of cell definition tags. Assume for the strings in the language, that all the cell contents are removed and only tags are present.
3. Construct a PDA diagram for the above scenario
4. Demonstrate the acceptance of any string in the language, with the turnstile notation and Instantaneous description. (7)
5. Consider the following Context free grammar for English <S> → <NP1><VP>

<NP1> → <Article1><N1>

<Article1> →the

<N1> → peacock

<VP> → <V><Article2><adj><N2>

<V> → is

<Article2> →a

<adj> beautiful

<N2> → bird

<N3> ->creature

a) Derive the string “The peacock is a beautiful bird”(2)

b) Draw the parse tree for the string "The peacock is a beautiful bird" (2)

c) Eliminate the useless symbols

d) Convert to PDA.

1. The college organized a Teacher’s celebration event for all its employees. The employees participated in various games of the events. One such game is picking the colour flowers from the pool. The employee has to pick the flowers in the order specified. The One who is picking all the flowers in the specified order at the earliest is the winner. The coloured flowers are Red, Green, violet and yellow.

**Case (i):** First, they should pick ‘2m’ number of red flowers then ‘4n’ number of green flowers then ‘n’ number of Violet flowers and at last ‘m’ number of yellow flowers.

**Case (ii):** First they should pick ‘n’ number of red flowers then ‘2n’ Number of Green flowers. The order should not vary. Design a single Push down Automata to check the order and constraints of the game satisfying both the cases. Explain the designed PDA with example strings.

1. Difference between PDA and NPDA – 2 marks

2. Write the Language for both cases– 4 marks

3. Construction of PDA for the given statement – 8 marks

4. Example for First case – 3 marks

5. Example for Second case – 3 marks

6. Find whether the given Grammar is ambiguous or not- 5 marks