Varianta 1

1. Present the Context Free Grammar in Chomsky Normal Form

$G=(V_N, V_T, P, S)$, $V_N=\{S, A, B\}$, $V_T=\{a, b\}$

$P=\{1.\ S \rightarrow A$ $2.\ S \rightarrow aB$ $3.\ A \rightarrow bAa$ $4.\ A \rightarrow aS$

    $5.\ A \rightarrow a$ $6.\ B \rightarrow AbB$ $7.\ B \rightarrow BS$ $8.\ B \rightarrow \varepsilon \}$

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

$P=\{ 1.\ S \rightarrow aA$ $2.\ A \rightarrow b$ $3.\ A \rightarrow BA$ $4.\ B \rightarrow C$ $5.\ C \rightarrow a$ $6.\ C \rightarrow BS \}$.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e,f,g,e\}$,

$P=\{ 1.\ S \rightarrow Ag$ $2.\ A \rightarrow abcB$ $3.\ B \rightarrow Cd$

     $4.\ C \rightarrow e$ $5.\ C \rightarrow CfD$ $6.\ D \rightarrow e \}$,

build the matrix of simple precedence, analyze the ***abcefedg*** string and construct the derivation tree.

4. Construct pushdown automata for the following language :

$L=\{a^n ba^{2n} \mid m,n \in N\}$ Present the analysis of the word.

_____

Varianta 2

1. Present the Context Free Grammar in Chomsky Normal Form

$G=(V_N, V_T, P, S)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$

$P=\{1.\ S \rightarrow aB$ $2.\ S \rightarrow AC$ $3.\ A \rightarrow a$ $4.\ A \rightarrow ASC$

    $5.\ A \rightarrow BC$ $6.\ B \rightarrow b$ $7.\ B \rightarrow bS$ $8.\ C \rightarrow \varepsilon$ $9.\ C \rightarrow BA\}$

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

$P=\{ 1.\ S \rightarrow AC$ $2.\ C \rightarrow a$ $3.\ B \rightarrow aA$ $4.\ B \rightarrow BC$ $5.\ A \rightarrow b$ $6.\ A \rightarrow SB \}$.

3. For the given Push Down Automaton $M=(Q, \Sigma, \Gamma, \delta, q0, Z0, F)$, $Q=\{q0,q1, q2\}$, $\Sigma=\{a,b,d\}$, $\Gamma=\{a,b, A,B,D\}$, $q0=\{q0\}$, $Z0=\{\varepsilon\}$, $F=\{q2\}$

   $\delta(q0,d,\varepsilon) = \{(q1,D)\}$ $\delta(q1,b, \varepsilon) = \{(q1,B)\}$ $\delta(q1, \varepsilon, \varepsilon) = \{(q2, \varepsilon)\}$

   $\delta(q2,d,D) = \{(q2, \varepsilon)\}$ $\delta(q2,b,B) = \{(q2, \varepsilon)\}$

   a) Present the PDA in the graph form.

   b) Present the PDA in the table form.

   c) Analyze the word: *dbbbbd.*

4. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, B, D, A\}$, $V_T=\{a,b,c,d\}$,

     $P=\{ 1.\ S \rightarrow dA$ $2.\ A \rightarrow E$ $3.\ A \rightarrow EcA$

       $4.\ E \rightarrow bD$ $5.\ D \rightarrow a$ $6.\ D \rightarrow aD$ $\}$.

build the matrix of simple precedence, analyze the ***dbaacba*** string and construct the derivation tree.

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Varianta 3

1. Present the Context Free Grammar in Chomsky Normal Form

$G = (V_N,V_T, P, S)$, $V_N=\{S,A,B\}$, $V_T=\{a,b\}$

$P=\{1.\ S \rightarrow aB$ $2.\ S \rightarrow baA$ $3.\ A \rightarrow a$ $4.\ A \rightarrow aS$

     $5.\ A \rightarrow bAaB$ $6.\ B \rightarrow A$ $7.\ B \rightarrow BS$ $8.\ B \rightarrow \varepsilon \}$.

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

$P=\{ 1.\ S \rightarrow BC$ $2.\ C \rightarrow BB$ $3.\ C \rightarrow a$ $4.\ A \rightarrow b$ $5.\ B \rightarrow CA$ $\}$.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, B, D, A\}$, $V_T=\{a,b,c,d\}$,

     $P=\{ 1.\ S \rightarrow dA$ $2.\ A \rightarrow D$ $3.\ A \rightarrow DcA$

       $4.\ D \rightarrow bE$ $5.\ E \rightarrow a$ $6.\ E \rightarrow aE$ $\}$.

build the matrix of simple precedence, analyze the ***dbacbaa*** string and construct the derivation tree.

4. Construct pushdown automata for the following language :

$L=\{a^n b^m a^k \mid m,n,k \in N, k < m\}$ Present the analysis of the word.

_____

Varianta 4

1. Present the Context Free Grammar in Chomsky Normal Form

$G = (V_N, V_T, P, S)$, $V_N=\{S,A,B\}$, $V_T=\{a,b\}$

$P=\{1.\ S \rightarrow aB$ $2.\ S \rightarrow AB$ $3.\ A \rightarrow a$ $4.\ A \rightarrow aS$

     $5.\ A \rightarrow ABAB$ $6.\ B \rightarrow A$ $7.\ B \rightarrow bS$ $8.\ B \rightarrow \varepsilon\}$

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

$P=\{ 1.\ S \rightarrow bA$ $2.\ A \rightarrow BC$ $3.\ B \rightarrow b$ $4.\ B \rightarrow A$ $5.\ C \rightarrow B$ $6.\ C \rightarrow a \}$.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e\}$,

     $P=\{ 1.\ S \rightarrow E$ $2.\ E \rightarrow F$ $3.\ E \rightarrow FeE$

       $4.\ F \rightarrow abD$ $5.\ D \rightarrow Rc$ $6.\ R \rightarrow d$ $7.\ R \rightarrow Rd$ $\}$.

build the matrix of simple precedence, analyze the ***abdceabdc*** string and construct the derivation tree.

4. Construct pushdown automata for the following language :

$L=\{a^m b^m b^n a^n \mid m,n \in N\}$ Present the analysis of the word.

Varianta 5

1. Present the Context Free Grammar in Chomsky Normal Form

    $G = (V_N, V_T, P, S)$, $V_N = \{S, A, B\}$, $V_T = \{a, b\}$

    P= {1. S $\rightarrow$ a B 2. S $\rightarrow$ A B   3. A $\rightarrow$ a   4. A $\rightarrow$ a S

        5. A $\rightarrow$ A B A B   6. B $\rightarrow$ A   7. B $\rightarrow$ b S   8. B $\rightarrow$ ε}

2. Convert the given grammar to the Greibach Normal Form

    $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

    P= { 1. S $\rightarrow$ b A   2. A $\rightarrow$ B C   3. B $\rightarrow$ b 4. B $\rightarrow$ A   5. C $\rightarrow$ B   6. C $\rightarrow$ a }.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e,f,g,e\}$,

    $P=\{$ 1. $S \rightarrow A\,e$ 2. $A \rightarrow b\,a\,F$ 3. $F \rightarrow E\,d$

      4. $E \rightarrow D$ 5. $E \rightarrow E\,b\,D$ 6. $D \rightarrow c$ }.

build the matrix of simple precedence, analyze the ***bacbcde*** string and construct the derivation tree.

4. Construct pushdown automata for the following language :

$L = \{a^n a^n b^{2n} \mid m, n \in N\}$ Present the analysis of the word.

_____

Varianta 6

1. Present the Context Free Grammar in Chomsky Normal Form

    $G = (V_N, V_T, P, S)$, $V_N = \{S, A, B\}$, $V_T = \{a, b\}$

    P= {1. S $\rightarrow$ a B 2. S $\rightarrow$ b a A   3. A$\rightarrow$ a   4. A$\rightarrow$ a S

        5. A$\rightarrow$ b A a B   6. B$\rightarrow$ A   7. B$\rightarrow$ B S   8. B $\rightarrow$ ε }.

2. Convert the given grammar to the Greibach Normal Form

    $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

    P= { 1. S $\rightarrow$ B C   2. C $\rightarrow$ B B   3. C $\rightarrow$ a 4. A $\rightarrow$ b   5. B $\rightarrow$ C A   }.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, D\}$, $V_T=\{a,b,c,d\}$,

    $P=\{$ 1. $S \rightarrow A\,a\,b\,H$ 2. $H \rightarrow R\,c$ 3. $R \rightarrow f$

      4. $R \rightarrow R\,d\,f$ 5. $A \rightarrow e$ 6. $A \rightarrow A\,d\,e$ },

build the matrix of simple precedence, analyze the ***edeabfdfc*** string and construct the derivation tree.

4. Construct pushdown automata for the following language :

$L = \{a^n b^n a^k \mid m, n \in N, k = n-1\}$ Present the analysis of the word.

_____

Varianta 7

1. Present the Context Free Grammar in Chomsky Normal Form

    $G=(V_N, V_T, P, S)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$

    P={1. S$\rightarrow$aB   2. S$\rightarrow$AC   3. A$\rightarrow$a   4. A$\rightarrow$ASC

        5. A$\rightarrow$BC 6. B$\rightarrow$b   7. B$\rightarrow$bS   8. C$\rightarrow$ε 9. C $\rightarrow$ BA}

2. Convert the given grammar to the Greibach Normal Form

    $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

    P= { 1. S $\rightarrow$ A C   2. C $\rightarrow$ a   3. B $\rightarrow$ a A 4. B $\rightarrow$ B C   5. A $\rightarrow$ b   6. A $\rightarrow$ S B }.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, F, L, E\}$, $V_T=\{a,b,c,d,e\}$,

    $P=\{$ 1. $S \rightarrow L\,d\,X$ 2. $X \rightarrow D$ 3. $L \rightarrow c\,a$

      4. $L \rightarrow L\,a$ 5.$D \rightarrow b$ 6. $D \rightarrow D\,e\,b$ }.

build the matrix of simple precedence, analyze the ***caaadbebeb*** string and construct the derivation tree.

4. Construct pushdown automata for the following language :

$$L = \{a^n a^m a^{2n} \mid m, n \in N\}$$ Present the analysis of the word.

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Varianta 8

1. Present the Context Free Grammar in Chomsky Normal Form

    $G=(V_N, V_T, P, S)$, $V_N=\{S, A, B\}$, $V_T=\{a, b\}$

    P={1. S $\rightarrow$ A   2. S $\rightarrow$aB   3. A $\rightarrow$bAa   4. A $\rightarrow$aS

        5. A $\rightarrow$ a 6. B$\rightarrow$AbB   7. B$\rightarrow$BS   8. B $\rightarrow$ε }

2. Convert the given grammar to the Greibach Normal Form

    $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

    P= { 1. S $\rightarrow$ a A   2. A $\rightarrow$ b   3. A $\rightarrow$ B A 4. B $\rightarrow$ C   5. C $\rightarrow$ a   6. C $\rightarrow$ B S }.

3. Construct pushdown automata for the following language :

$L = \{a^n b^m a^k \mid m, n, k \in N, k < m\}$ Present the analysis of the word.

4. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,f,g\}$,

    $P=\{$ 1. $S \rightarrow A$ 2. $A \rightarrow A\,E$ 3. $E \rightarrow A\,D$

      4. $A \rightarrow a$ 5. $A \rightarrow b$ 6. $D \rightarrow c$ 7. $D \rightarrow d$ }.

build the matrix of simple precedence, analyze the ***baacdad*** string and construct the derivation tree.

Varianta 9

1. Present the Context Free Grammar in Chomsky Normal Form

$G=(V_N, V_T, P, S)$, $V_N=\{S, A, B, D\}$, $V_T=\{a, b\}$

$P=\{1.\ S \to aB$ $2.\ S \to DA$ $3.\ A \to a$ $4.\ A \to BD$

$5.\ A \to bDAB$ $6.\ B \to b$ $7.\ B \to BA$ $8.\ D \to \varepsilon$ $9.\ D \to BA\}$

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

$P=\{1.\ S \to b\ A$ $2.\ A \to S\ C$ $3.\ B \to A$ $4.\ A \to a$ $5.\ A \to B\ C$ $6.\ C \to b\ \}$.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a,b,c,d,e, f\}$,

$P=\{1.\ S \to L\ d\ F$ $2.\ F \to E$ $3.\ L \to c\ a$

$4.\ L \to L\ a$ $5.\ E \to b$ $6.\ E \to E\ e\ b\ \}$.

build the matrix of simple precedence, analyze the **caadbeb** string and construct the derivation tree.

4. For the given Push Down Automaton $M=(Q, \Sigma, \Gamma, \delta, q0, Z0, F)$, $Q=\{q0,q1, q2\}$, $\Sigma=\{a,b,c\}$, $\Gamma=\{a,b, A,B\}$, $q0=\{q0\}$, $Z0=\{\varepsilon\}$, $F=\{q2\}$

$\delta(q0,a,\varepsilon) = \{(q1,A)\}$ $\delta(q1,b, \varepsilon) = \{(q1,B)\}$ $\delta(q1, c, \varepsilon) = \{(q2, \varepsilon)\}$

$\delta(q2,a,A) = \{(q2, \varepsilon)\}$ $\delta(q2,b,B) = \{(q2, \varepsilon)\}$

a) Present the PDA in the graph form.

b) Present the PDA in the table form.

c) Analyze the word: *abbcbba*.

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Varianta 10

1. Present the Context Free Grammar in Chomsky Normal Form

$G = (V_N,V_T, P, S)$, $V_N= \{S,A,B\}$, $V_T = \{a,b\}$

$P= \{1.\ S \to\ a\ B$ $2.\ S \to\ B\ A$ $3.\ A \to\ a$ $4.\ A \to b\ B$

$5.\ A \to\ A\ a\ b\ B$ $6.\ B \to\ \varepsilon$ $7.\ B \to\ b\ S$ $8.\ B \to\ a\ A\ B\ A\ \}$

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

$P=\{1.\ S \to\ b\ B$ $2.\ A \to B\ A$ $3.\ B \to A\ C$ $4.\ A \to B$ $5.\ A \to b$ $6.\ C \to a\ \}$.

3. Construct pushdown automata for the following language :

$L = \{a^{2m}b^n a^n | m, n\ \epsilon N\}$. Present the analysis of the word.

4. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e,f\}$,

$P=\{1.\ S \to\ A$ $2.A \to a\ D$ $3.\ D \to b$

$4.\ D \to b\ D$ $5.\ D \to A\ c\ \}$,

build the matrix of simple precedence, analyze the **ababbc** string and construct the derivation tree.

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Varianta 11

1. Present the Context Free Grammar in Chomsky Normal Form

$G = (V_N,V_T, P, S)$, $V_N= \{S,A,B\}$, $V_T = \{a,b\}$

$P= \{1.\ S \to\ a\ B$ $2.\ S \to\ b\ A$ $3.\ A \to\ B\ S$ $4.\ A \to\ a\ S$

$5.\ A \to\ A\ b\ a\ B$ $6.\ B \to\ A$ $7.\ B \to\ b\ S$ $8.\ B \to\ \varepsilon\ \}$

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

$P=\{1.\ S \to\ C\ A$ $2.\ C \to A\ B$ $3.\ A \to C$ $4.\ A \to a$ $5.\ B \to b\ \}$.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e,f,g,e\}$,

$P=\{1.\ S \to\ A$ $2.\ A \to E$ $3.\ A \to A\ c\ E$

$4.\ E \to a$ $5.\ E \to b$ $6.\ E \to d\ D$ $7.\ D \to A\ e\ \}$,

build the matrix of simple precedence, analyze the **daecdbe** string and construct the derivation tree.

4. For the given Push Down Automaton $M=(Q, \Sigma, \Gamma, \delta, q0, Z0, F)$, $Q=\{q0,q1, q2\}$, $\Sigma=\{a,b, c\}$, $\Gamma=\{a,b, A,B,C\}$, $q0=\{q0\}$, $Z0=\{\varepsilon\}$, $F=\{q2\}$

$\delta(q0, \varepsilon,\varepsilon) = \{(q1, \varepsilon)\}$ $\delta(q1,b, \varepsilon) = \{(q1,B)\}$ $\delta(q1,a, \varepsilon) = \{(q1,A)\}$

$\delta(q1, c, \varepsilon) = \{(q2, \varepsilon)\}$ $\delta(q2,b,B) = \{(q2, \varepsilon)\}$ $\delta(q2,a,A) = \{(q2, \varepsilon)\}$

a) Present the PDA in the graph form.

b) Present the PDA in the table form.

c) Analyze the word: *aaacaaa*.

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Varianta 12

1. Present the Context Free Grammar in Chomsky Normal Form

$G = (V_N,V_T, P, S)$, $V_N= \{S,A,B\}$, $V_T = \{a,b\}$

$P= \{1.\ S \to\ a\ B$ $2.\ S \to\ b\ A$ $3.\ A \to\ B$ $4.\ A \to\ A\ S$

$5.\ A \to\ b\ B\ A\ B$ $6.\ A \to\ \varepsilon$ $7.\ B \to\ b$ $8.\ B \to\ b\ S\ \}$

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

$P=\{1.\ S \to\ b\ C$ $2.\ B \to C\ A$ $3.\ A \to a$

$4.\ C \to B$ $6.\ C \to b\ \}$.

3. Convert the given context free grammar to the Push Down Automaton

$G=(V_N, V_T, P, S)$, $V_N=\{S, A, B, D\}$, $V_T=\{a, b\}$

$P=\{1.\ S \to aB$ $2.\ S \to DA$ $3.\ A \to a$ $4.\ A \to BD$

$5.\ A \to bDAB$ $6.\ B \to b$ $7.\ B \to BA$ $8.\ D \to \varepsilon$ $9.\ D \to BA\}$

4. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, F, L, E\}$, $V_T=\{a,b,c,d,e\}$,

$P=\{1.\ S \to\ d\ A$ $2.\ A \to E$ $3.\ A \to E\ c\ A$

$4.\ E \to b\ D$ $5.D \to a$ $6.\ D \to a\ D\ \}$.

build the matrix of simple precedence, analyze the **dbaacba** string and construct the derivation tree.

Varianta 13

1. Present the Context Free Grammar in Chomsky Normal Form

$G=(V_N, V_T, P, S)$, $V_N=\{S, A, B\}$, $V_T=\{a, b\}$

$P=\{$1. $S \rightarrow A$ 2. $S \rightarrow aB$ 3. $A \rightarrow bAa$ 4. $A \rightarrow aS$
5. $A \rightarrow a$ 6. $B \rightarrow AbB$ 7. $B \rightarrow BS$ 8. $B \rightarrow \varepsilon$ $\}$

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

$P=\{$ 1. $S \rightarrow A C$ 2. $C \rightarrow b A$ 3. $A \rightarrow S$ 4. $A \rightarrow b$ 5. $B \rightarrow A$ 6. $B \rightarrow a$ $\}$.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, B, D, A\}$, $V_T=\{a,b,c,d\}$,

$P=\{$ 1. $S \rightarrow d A$ 2. $A \rightarrow D$ 3. $A \rightarrow D c A$
4. $D \rightarrow b E$ 5. $E \rightarrow a$ 6. $E \rightarrow a E$ $\}$,

build the matrix of simple precedence, analyze the **dbacbaa** string and construct the derivation tree.

4. Construct pushdown automata for the following language :

$L=\{a^n b^m a^k \mid m,n,k \in N, m+n=k\}$ Present the analysis of the word.

Varianta 14

1. Present the Context Free Grammar in Chomsky Normal Form

$G=(V_N, V_T, P, S)$, $V_N=\{S, A, B\}$, $V_T=\{a, b\}$

$P=\{$1. $S \rightarrow Ab$ 2. $S \rightarrow aB$3. $A \rightarrow bAa$ 4. $A \rightarrow aS$
5. $A \rightarrow B$ 6. $B \rightarrow AbB$ 7. $B \rightarrow BS$ 8. $B \rightarrow \varepsilon$ 9. $A \rightarrow a$ $\}$

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

$P=\{$ 1. $S \rightarrow a A$ 2. $A \rightarrow b$ 3. $A \rightarrow B A$ 4. $B \rightarrow C$ 5. $C \rightarrow a$ 6. $C \rightarrow B S$ $\}$.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, B, D, A\}$, $V_T=\{a,b,c,d\}$,

$P=\{$ 1. $S \rightarrow E$ 2. $E \rightarrow F$ 3. $E \rightarrow F e E$
4. $F \rightarrow a b D$ 5. $D \rightarrow R c$ 6. $R \rightarrow d$ 7. $R \rightarrow R d$ $\}$.

build the matrix of simple precedence, analyze the **abdceabdc** string and construct the derivation tree.

4. For the given PDA $M=(Q, \Sigma, \Gamma, \delta, q0, Z0, F)$ given in the table form

δ	a	b	c	d	ε
➔ q0	q0 ε| A	q0 ε| B		-	q1 ε| ε
q1	q2 ε| ε	-	-	-	
* q2	q0 A| ε	q0 B| ε	-	-	-

a) Present the PDA in the graph form.
b) Present the PDA in the analytical form.
c) Analyze the word: *abbabba*.

Varianta 15

1. Present the Context Free Grammar in Chomsky Normal Form

$G=(V_N, V_T, P, S)$, $V_N=\{S, A, B, D\}$, $V_T=\{a, b\}$

$P=\{$1. $S \rightarrow aB$ 2. $S \rightarrow DA$ 3. $A \rightarrow a$ 4. $A \rightarrow aBD$
5. $A \rightarrow bDAB$ 6. $B \rightarrow D$ 7. $B \rightarrow BA$ 8. $D \rightarrow \varepsilon$ 9. $D \rightarrow BA$ 10. $B \rightarrow a$ $\}$

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

$P=\{$ 1. $S \rightarrow b A$ 2. $A \rightarrow S C$ 3. $B \rightarrow A$ 4. $A \rightarrow a$ 5. $A \rightarrow B C$ 6. $C \rightarrow b$ $\}$.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d\}$,

$P=\{$ 1. $S \rightarrow A e$ 2. $A \rightarrow b a F$ 3. $F \rightarrow E d$
4. $E \rightarrow D$ 5. $E \rightarrow E b D$ 6. $D \rightarrow c$ $\}$, build the matrix of simple precedence, analyze the

bacbcde string and construct the derivation tree.

4. For the given PDA $M=(Q, \Sigma, \Gamma, \delta, q0, Z0, F)$ given in the table form

δ	a	b	c	d	ε
➔ q0	q0 ε| A	q0 ε| B		-	q1 ε| ε
q1	-	q2 ε| ε	-	-	
* q2	q0 A| ε	q0 B| ε	-	-	-

a) Present the PDA in the graph form.
b) Present the PDA in the analytical form.
c) Analyze the word: *abbbbba*.

Varianta 16

1. Present the Context Free Grammar in Chomsky Normal Form

$G = (V_N, V_T, P, S)$, $V_N= \{S, A, B\}$, $V_T = \{a, b\}$

$P= \{$1. $S \rightarrow a B$ 2. $S \rightarrow aB A$ 3. $A \rightarrow B$ 4. $A \rightarrow b B$
5. $A \rightarrow A a b B$ 6. $B \rightarrow \varepsilon$ 7. $B \rightarrow b S$ 8. $B \rightarrow a A B A$ 9. $A \rightarrow a$ $\}$

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

$P=\{$ 1. $S \rightarrow b B$ 2. $A \rightarrow B A$ 3. $B \rightarrow A C$ 4. $A \rightarrow B$ 5. $A \rightarrow b$ 6. $C \rightarrow a$ $\}$.

3 For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e\}$,

$P=\{$ 1. $S \rightarrow A a b H$ 2. $H \rightarrow R c$ 3. $R \rightarrow f$
4. $R \rightarrow R d f$ 5. $A \rightarrow e$ 6. $A \rightarrow A d e$ $\}$, build the matrix of simple precedence,

analyze the **edeabfdfc** string and construct the derivation tree.

4. Construct pushdown automata for the following language :

$L=\{a^n b a^k \mid m,n \in N, k = n-1\}$ Present the analysis of the word.

1. Present the Context Free Grammar in Chomsky Normal Form

$G = (V_N, V_T, P, S)$, $V_N = \{S,A,B\}$, $V_T = \{a,b\}$

P= {1. S→ a B 2. S→ b A   3. A→ B   4. A→ a S

  5. A→ A b a B   6. B→ a   7. B→ b S   8. B→ ε 9. A→a }

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

P={ 1. S → C A   2. C → A B   3. A → C 4. A → a   5. B → b }.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e\}$,

P={ 1. S → A e   2. A → b a B   3. B → C d

  4. C → D   5. C → C b D   6. D → c   },

 build the matrix of simple precedence, analyze the ***bacbcbcde*** string and construct the derivation tree.

4. For the given Push Down Automaton $M=(Q, \Sigma, \Gamma, \delta, q0, Z0, F)$, $Q=\{q0,q1, q2\}$, $\Sigma =\{a,b,c\}$, $\Gamma=\{a,b, A,B,C\}$, $q0=\{q0\}$, $Z0=\{ \varepsilon \}$, $F=\{q2\}$

  $\delta(q0,c,\varepsilon) = \{(q1,C)\}$ $\delta(q1,b, \varepsilon) = \{(q1,B)\}$ $\delta(q1, \varepsilon, \varepsilon) = \{(q2, \varepsilon)\}$
  $\delta(q2,c,C) = \{(q2, \varepsilon)\}$ $\delta(q2,b,B) = \{(q2, \varepsilon)\}$

  a) Present the PDA in the graph form.
  b) Present the PDA in the table form.
  c) Analyze the word: *cbbbbc*.

1. Present the Context Free Grammar in Chomsky Normal Form

$G = (V_N, V_T, P, S)$, $V_N = \{S,A,B\}$, $V_T = \{a,b\}$

P= {1. S → a B 2. S → b A   3. A → a   4. A → A S

  5. A → b B A B   6. A → ε   7. B → A   8. B → b S }

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

P={ 1. S → b C   2. B → C A   3. A → a 4. C → B   6. C → b }.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d\}$,

P={ 1. S → d B   2. B → C   3. B → C c B

  4. C → b A   5. A → a   6. A → a A   },

 build the matrix of simple precedence, analyze the ***dbacbaaa*** string and construct the derivation tree.

4. Construct pushdown automata for the following language :

$L = \{a^n b^m a^{n+1} \mid m,n \in N\}$ Present the analysis of the word.

1. Present the Context Free Grammar in Chomsky Normal Form

$G=(V_N, V_T, P, S)$, $V_N=\{S, A, B\}$, $V_T=\{a, b\}$

P={1. S → aA   2. S →aB   3. A →bAa   4. A →B

  5. A → a   6. B →AbB   7. B → BS   8. B →ε }

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

P={ 1. S → A C   2. C → b A   3. A → S 4. A → b   5. B → A   6. B → a }.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a,b,c\}$,

P={ 1. S → aA   2. A → C   3. A → C b A

 4. C → d B   5. B → b   6. B → a B   },

 build the matrix of simple precedence, analyze the ***adbbdb*** string and construct the derivation tree.

4. Construct pushdown automata for the following language :

$L = \{a^{2n} b^m a^n \mid m,n \in N\}$ Present the analysis of the word.

1. Present the Context Free Grammar in Chomsky Normal Form

$G = (V_N, V_T, P, S)$, $V_N = \{S, L, A, I\}$, $V_T = \{a,b\}$

P= { 1. S→ L 2. L→ aA I   3. L→ a A   4. L→ L a A

  5. L→ L b I   6. A→ I   7. I→ b 8. I→ ε }.

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

P={ 1. S → aC   2. C → BA   3. C → a 4. B → A   5. A → b   6. A → BA   }.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e\}$,

P={ 1. S → L d X   2. X → D   3. L → c a

  4. L → aL   5. D → b   6. D → eDb   },

 build the matrix of simple precedence, analyze the string ***aaaacadeebbb*** and construct the derivation tree.

4. Construct pushdown automata for the following language :

$L = \{a^n b^{2n} a^n \mid m,n \in N\}$ Present the analysis of the word.

Varianta 21

1. Present the Context Free Grammar in Chomsky Normal Form
$G = (V_N, V_T, P, S)$, $V_N= \{S,A,B\}$, $V_T = \{a,b\}$
P= {1. S → a B   2. S → aA B   3. A → a   4. A → B
5. A → A B aA B   6. B → aA   7. B → b S   8. B → ε}

2. Convert the given grammar to the Greibach Normal Form
$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,
P={ 1. S → b A   2. A → B C   3. B → b   4. B → A   5. C → B   6. C → a }.

3. For the given PDA   M=(Q, Σ, Γ, δ, q0, Z0, F) given in the table form

δ	a	b	c	d	ε
→ q0	q0 ε| A	q0 ε| B	q1 ε| ε	-	
q1	-	-	q2 ε| ε	-	
* q2	q0 A| ε	q0 B| ε	-	-	-

a) Present the PDA in the graph form.
b) Present the PDA in the analytical form.
c) Analyze the word: *abbccbba.*

4. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e\}$,
P={ 1. S → C   2. C → B c A   3. A → b
4. A → d D   5. D → B e   6. B → a   7. B → B b a   },
build the matrix of simple precedence, analyze the *abacdae* string and construct the derivation tree.

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Varianta 22

1. Present the Context Free Grammar in Chomsky Normal Form
$G = (V_N,V_T, P, S)$, $V_N= \{S,A,B\}$, $V_T = \{a,b\}$
P= {1. S → a B   2. S → b a A   3. A → a   4. A → B
5. A → b A a B   6. B → aA   7. B → B S   8. B → ε }.

2. Convert the given grammar to the Greibach Normal Form
$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,
P={ 1. S → B C   2. C → B B   3. C → a 4. A → b   5. B → C A   }.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N =\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e\}$,
P={ 1. S → A   2. A → C   3. A → A c C
4. C → a   5. C → b   6. C → d D   7. D → A e   },
build the matrix of simple precedence, analyze the *dacbcbeca* string and construct the derivation tree.

4. Construct pushdown automata for the following language :
$L = \{a^{2m}b^m a^k \mid m,n,k \in N\}$ Present the analysis of the word.

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Varianta 23

1. Present the Context Free Grammar in Chomsky Normal Form
$G=(V_N, V_T, P, S)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$
P={1. S→aB   2. S→AaC   3. A→a 4. A→ASC
5. A→BaC   6. B→b 7. B→C 8. C→ε 9. C → BA}

2. Convert the given grammar to the Greibach Normal Form
$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,
P={ 1. S → A C   2. C → a   3. B → a A 4. B → B C   5. A → b   6. A → S B }.

3. For the given PDA   M=(Q, Σ, Γ, δ, q0, Z0, F) given in the table form

δ	a	b	c	d	ε
→ q0	q0 ε| A	q0 ε| B	q1 ε| ε	-	-
q1	-	-	-	-	q2 ε| ε
* q2	q0 A| ε	q0 B| ε	-	-	-

a) Present the PDA in the graph form.
b) Present the PDA in the analytical form.
c) Analyze the word: *abcba.*

4. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N =\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e\}$,
P={ 1. S → B   2. B → C   3. B → C c B
4. C → a d D   5. D → A e   6. A → b   7. A → A b, 8. B → d },
build the matrix of simple precedence, analyze the *adabcd* string and construct the derivation tree.

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Varianta 24

1. Present the Context Free Grammar in Chomsky Normal Form
$G=(V_N, V_T, P, S)$, $V_N=\{S, A, B\}$, $V_T=\{a, b\}$
P={1. S → Aa   2. S →aB 3. A →bAa   4. A →B
5. A → a   6. B→AbB   7. B→BS   8. B →ε }

2. Convert the given grammar to the Greibach Normal Form
$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,
P={ 1. S → a A   2. A → b   3. A → B A   4. B → C   5. C → a   6. C → B S }.

3. Convert the given context free grammar to the Push Down Automaton
$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,
P={ 1. S → b A   2. A → B C   3. B → b 4. B → A   5. C → B   6. C → a }.

4. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N =\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e,f,g\}$,
P={ 1. S → C f   2. C → a b B   3. B → D c
4. D → A   5. D → g A   6. A → d   7. A → e   },
build the matrix of simple precedence, analyze the *abgdcf* string and construct the derivation tree.

Varianta 25

1. Present the Context Free Grammar in Chomsky Normal Form

G = (V_N, V_T, P, S), V_N= {S,A,B}, V_T = {a,b}

P= {1. S→ a B   2. S→ aB A   3. A→ B   4. A→ b B

5. A→ A a b B   6. B→ ε   7. B→ b S   8. B→ a A B A   9. A → a }

2. Convert the given grammar to the Greibach Normal Form

G=(V_N, V_T, P, S,), V_N={S, A, B, C}, V_T={a, b},

P={ 1. S → b B   2. A → B A   3. B → A C   4. A → B   5. A → b   6. C → a   }.

3. Convert the given context free grammar to the Push Down Automaton

G = (V_N, V_T, P, S), V_N= {S,A,B}, V_T = {a,b}

P= {1. S→ a B   2. S→ B A   3. A→ a   4. A→ b B

5. A→ A a b B   6. B→ ε   7. B→ b S   8. B→ a A B A }

4. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a,b,c,d,e, f\}$,

$P=\{$ 1. $S \to B\ c$ 2. $S \to B\ c\ d\ C$ 3. $C \to A\ e$

4. $A \to f$ 5. $A \to A\ b\ f$ 6. $B \to a$ 7. $B \to B\ b\ a$ },

build the matrix of simple precedence, analyze the ***abacdfbfe*** string and construct the derivation tree.

Varianta 26

1. Present the Context Free Grammar in Chomsky Normal Form

G = (V_N, V_T, P, S), V_N= {S,A,B}, V_T = {a,b}

P= {1. S→ a B 2. S→ b A   3. A→ B   4. A→ a S

5. A→ A b a B   6. B→ a   7. B→ b S   8. B→ ε 9. A→a }

2. Convert the given grammar to the Greibach Normal Form

G=(V_N, V_T, P, S,), V_N={S, A, B, C}, V_T={a, b},

P={ 1. S → C A   2. C → A B   3. A → C   4. A → a   5. B → b }.

3. For the given Push Down Automaton M=(Q, Σ, Γ, δ, q0, Z0, F), Q={q0,q1, q2}, Σ ={a,b, c}, Γ={a,b, A,B,C}, q0={q0}, Z0={ ε }, F={q2}

δ(q0, ε,ε) = {(q1, ε)}   δ(q1,b, ε) = {(q1,B)}   δ(q1,a, ε) = {(q1,A)}
δ(q1, ε, ε) = {(q2, ε)}   δ(q2,b,B) = {(q2, ε)}   δ(q2,a,A) = {(q2, ε)}

a) Present the PDA in the graph form.
b) Present the PDA in the table form.
c) Analyze the word: *aaaaaa.*

4. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e,f\}$,

$P=\{$ 1. $S \to A\ a$ 2. $S \to A\ a\ b\ B$ 3. $B \to C\ c$

4. $C \to f$ 5. $C \to C\ d\ f$ 6. $A \to e$ 7. $A \to A\ d\ e$ }, build the matrix of simple precedence,

analyze the ***ededeabfdfc*** string and construct the derivation tree.

Varianta 27

1. Present the Context Free Grammar in Chomsky Normal Form

G=(V_N, V_T, P, S), V_N={S, A, B, C}, V_T={a, b}

P={1. S→aB   2. S→AC   3. A→a   4. A→ASC

5. A→BC   6. B→b   7. B→bS   8. C→ε 9. C → BA}

2. Convert the given grammar to the Greibach Normal Form

G=(V_N, V_T, P, S,), V_N={S, A, B, C}, V_T={a, b},

P={ 1. S → A C   2. C → a   3. B → a A   4. B → B C   5. A → b   6. A → S B }.

3. For the given PDA   M=(Q, Σ, Γ, δ, q0, Z0, F) given in the table form

δ	a	b	c	d	ε
→ q0	q0 ε| A	q0 ε| B	q1 ε| ε	-	-
q1	-	-	-	Q2 ε| ε	-
* q2	q0 A| ε	q0 B| ε	-	-	-

a) Present the PDA in the graph form.
b) Present the PDA in the analytical form.
c) Analyze the word: *abcdba.*

4. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e,f,g,e\}$,

$P=\{$ 1. $S \to A\ g$ 2. $A \to a\ b\ c\ B$ 3. $B \to C\ d$

4. $C \to e$ 5. $C \to C\ f\ D$ 6. $D \to e$ },

build the matrix of simple precedence, analyze the ***abcefedg*** string and construct the derivation tree.

Varianta 28

1. Present the Context Free Grammar in Chomsky Normal Form

$G=(V_N, V_T, P, S)$, $V_N=\{S, A, B\}$, $V_T=\{a, b\}$

P=\{1. $S \to A$ 2. $S \to aB$ 3. $A \to bAa$ 4. $A \to aS$

     5. $A \to a$ 6. $B \to AbB$ 7. $B \to BS$ 8. $B \to \varepsilon$ \}

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

P=\{ 1. $S \to a A$ 2. $A \to b$ 3. $A \to B A$ 4. $B \to C$ 5. $C \to a$ 6. $C \to B S$ \}.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, B, D, A\}$, $V_T=\{a,b,c,d\}$,

P=\{ 1. $S \to d A$ 2. $A \to B$ 3. $A \to B c A$

     4. $B \to b D$ 5. $D \to a$ 6. $D \to a D$ \},

build the matrix of simple precedence, analyze the **dbaacbaaa** string and construct the derivation tree.

4. Construct pushdown automata for the following language :

$L = \{ab^m a^{2m} \mid m,n,k \in N\}$ Present the analysis of the word.

Varianta 29

1. Present the Context Free Grammar in Chomsky Normal Form

$G=(V_N, V_T, P, S)$, $V_N=\{S, A, B, D\}$, $V_T=\{a, b\}$

P=\{1. $S \to aB$ 2. $S \to DA$ 3. $A \to a$ 4. $A \to BD$

     5. $A \to bDAB$ 6. $B \to b$ 7. $B \to BA$ 8. $D \to \varepsilon$ 9. $D \to BA\}$

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

P=\{ 1. $S \to b A$ 2. $A \to S C$ 3. $B \to A$ 4. $A \to a$ 5. $A \to B C$ 6. $C \to b$ \}.

3. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, B, D, A\}$, $V_T=\{a,b,c,d\}$,

P=\{ 1. $S \to d B$ 2. $B \to a$ 3. $B \to a A$

     4. $A \to D$ 5. $A \to D c A$ 6. $D \to b B$ 7. $A \to c$ \},

build the matrix of simple precedence, analyze the **dabacba** string and construct the derivation tree.

4. Construct pushdown automata for the following language :

$L = \{a^{2n} b^n a^n \mid m,n \in N\}$ Present the analysis of the word.

Varianta 30

1. Present the Context Free Grammar in Chomsky Normal Form

$G = (V_N, V_T, P, S)$, $V_N= \{S,A,B\}$, $V_T = \{a,b\}$

P= \{1. $S \to a B$ 2. $S \to B A$ 3. $A \to a$ 4. $A \to b B$

     5. $A \to A a b B$ 6. $B \to \varepsilon$ 7. $B \to b S$ 8. $B \to a A B A$ \}

2. Convert the given grammar to the Greibach Normal Form

$G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C\}$, $V_T=\{a, b\}$,

P=\{ 1. $S \to b B$ 2. $A \to B A$ 3. $B \to A C$ 4. $A \to B$ 5. $A \to b$ 6. $C \to a$ \}.

3. For the given PDA $M=(Q, \Sigma, \Gamma, \delta, q0, Z0, F)$ given in the table form

δ	a	b	c	d	ε
➔ q0	q0 ε| A	q0 ε| B	-	-	q1 ε| ε
q1	-	-	-	q2 ε| ε	-
* q2	q0 A| ε	q0 B| ε	-	-	-

a) Present the PDA in the graph form.

b) Present the PDA in the analytical form.

c) Analyze the word: *abdba.*

4. For the given grammar $G=(V_N, V_T, P, S,)$, $V_N=\{S, A, B, C, D\}$, $V_T=\{a,b,c,d,e\}$,

P=\{ 1. $S \to A$ 2. $A \to B$ 3. $A \to B e A$

     4. $B \to a b D$ 5. $D \to C d$ 6. $C \to c$ 7. $C \to C c$ \}, build the matrix of simple precedence,

analyze the **abcdeabcccd** string and construct the derivation tree.