

Homework-1

Q^{stn}: Is $G: S \rightarrow (s) | ss | \epsilon$ a context free grammar?
How would you interpret the string " $((((())) () ())$ " using above grammar?

Solⁿ: Yes, $G: S \rightarrow (s) | ss | \epsilon$ is a context free grammar because $\alpha \in V$ in $\alpha \rightarrow \beta$ where V is a non-terminal symbol (Here S).

We should start with source, S .

Given CFG, $S \rightarrow (s)$
 $\rightarrow (ss) \quad | \because S \rightarrow ss$
 $\rightarrow (sss) \quad | \because S \rightarrow ss$
 $\rightarrow ((s)ss) \quad | \because S \rightarrow (s)$
 $\rightarrow (((s))ss) \quad | \because S \rightarrow (s)$
 $\rightarrow (((((s))))ss) \quad | \because S \rightarrow (s)$
 $\rightarrow (((((())) ss) \quad | \because S \rightarrow \epsilon$
 $\rightarrow (((((())) (s) s) \quad | \because S \rightarrow (s)$
 $\rightarrow (((((())) () s) \quad | \because S \rightarrow \epsilon$
 $\rightarrow (((((())) () (s)) \quad | \because S \rightarrow (s)$
 $\rightarrow (((((())) () ()) \quad | \because S \rightarrow \epsilon$

Homework-2

Q^{8th}: Is $G: S \rightarrow OS1 \mid A$ a context free grammar?
 $A \rightarrow OA \mid \epsilon$

How would you interpret the string "00000111" using above grammar where $L = \{0^m 1^n \mid m \geq n\}$?

Solⁿ: Yes, $G: S \rightarrow OS1 \mid A$ a context free grammar because $\alpha \in V$ in $\alpha \rightarrow \beta$ where α is a non-terminal symbol (Here S, A).

We should start with source, S .

Given CFG, $S \rightarrow OS1$

$\rightarrow OOS11 \quad | \because S \rightarrow OS1$

$\rightarrow OOS111 \quad | \because S \rightarrow OS1$

$\rightarrow OOA111 \quad | \because S \rightarrow A$

$\rightarrow OOOA111 \quad | \because A \rightarrow OA$

$\rightarrow OOOOA111 \quad | \because A \rightarrow OA$

$\rightarrow OOOO111 \quad | \because A \rightarrow \epsilon$

Homework-3

Qstn: If a program containing if-then(-else) statements,
if condition then statement else statement
(Or)
if condition then statement
then what is the context free ~~language~~ ^{grammar} (CFG)?

Soln: Grammar:

$$S \rightarrow iCtSeS \mid iCtS \mid a$$

$$C \rightarrow b$$

where, S is the source, C is the non-terminal symbol and i, t, e, a, b are the terminal symbol.

So, this is a context free grammar because $\alpha \in V$ in $\alpha \rightarrow \beta$ where V is a non-terminal symbol (Here, S & C).

Homework-4

Q^{stn}: Given, $L = \{0^n \mid n \geq 0\}$ convert into context free grammar (CFG).

Solⁿ: Given, $L = \{0^n \mid n \geq 0\}$

$\therefore L = \{\epsilon, 00, 000, \dots\}$ that means

0 followed by 0 like $s \rightarrow 0 \mid 00 \mid 000 \mid \dots$ after ϵ .

So, followed by 0 is denoted by s and get

context free grammar, $G_1: s \rightarrow 0s \mid \epsilon$ $\left| \begin{array}{l} \therefore s \rightarrow 0s \\ \rightarrow 0\epsilon \\ \rightarrow 0 \end{array} \right.$

Homework-5

Q^{stn}: Given, $L = \{0^n \mid n \geq 1\}$ convert into context free grammar (CFG).

Solⁿ: Given, $L = \{0^n \mid n \geq 1\}$

$\therefore L = \{0, 00, 000, \dots\}$ that means

0 followed by 0 like $s \rightarrow 0 \mid 00 \mid 000 \mid \dots$

So, followed by 0 is denoted by s and get

context free grammar, $G_1: s \rightarrow 0s \mid 0$

Homework-6

Q^{8th}: Given, $L = \{0^i 1^j 2^k \mid i=j \text{ or } j=k, \text{ where } i, j, k \geq 0\}$
convert into context free grammar (CFG).

Solⁿ: Let, $i=j=n$ then $L_1 = 0^n 1^n 2^k$. Consider $0^n 1^n$ as A , 2^k as B and start symbol as S_1 .

\therefore Grammar for L_1 , G_{L_1} : $S_1 \rightarrow AB$

$$A \rightarrow 0A1 \mid \epsilon$$

$$B \rightarrow 2B \mid \epsilon$$

Again let, $j=k=m$ then $L_2 = 0^i 1^m 2^m$. Consider 0^i as C and $1^m 2^m$ as D and start symbol as S_2 .

\therefore Grammar for L_2 , G_{L_2} : $S_2 \rightarrow CD$

$$C \rightarrow 0C \mid \epsilon$$

$$D \rightarrow 1D2 \mid \epsilon$$

Given, $i=j$ or $j=k$

So, $G = G_{L_1} \cup G_{L_2}$ means main source symbol, $S = S_1 \cup S_2 = S_1 | S_2$

$$\therefore S = AB | CD$$

where $A \rightarrow 0A1 \mid \epsilon$

$$B \rightarrow 2B \mid \epsilon$$

and

$$C \rightarrow 0C \mid \epsilon$$

$$D \rightarrow 1D2 \mid \epsilon$$

Homework-7

Q⁷ⁿ: Given $L = \{0^i 1^j 2^k \mid i=j \text{ or } i=k, \text{ where } i, j, k \geq 1\}$
convert into context free grammar (CFG).

Solⁿ: Let $i=j=n$ then $L_1 = 0^n 1^n 2^k$. Consider
 $0^n 1^n$ as A , 2^k as B and start symbol as S_1 .

\therefore Grammar for L_1 , G_{L_1} : $S_1 \rightarrow AB$
 $A \rightarrow 0A1 \mid 01$
 $B \rightarrow 2B \mid 2$

Again let, $i=k=m$ then $L_2 = 0^m 1^j 2^m$
 $= 0^m 2^m 1^j$

Consider $0^m 2^m$ as C , 1^j as D and start symbol
as S_2 . \therefore Grammar for L_2 , G_{L_2} : $S_2 \rightarrow CD$

$C \rightarrow 0C2 \mid 02$

$D \rightarrow 1D \mid 1$

Given, $i=j$ or $i=k$

So, $G = G_{L_1} \cup G_{L_2}$ means main source
symbol, $S = S_1 \cup S_2 = S_1 \mid S_2$

$\therefore S = AB \mid CD$

where $A \rightarrow 0A1 \mid 01$ and $C \rightarrow 0C2 \mid 02$
 $B \rightarrow 2B \mid 2$ $D \rightarrow 1D \mid 1$