What is Handle Pruning?

Handle: The **handle** is the substring that matches the body of a production whose reduction represents one step along with the reverse of a rightmost derivation.

The handle of the right sequential form Y is the production of Y where the string S may be found and replaced by A to produce the previous right sequential form in RMD(Right Most Derivation) of Y.

Sentential form: S => a here, 'a' is called sentential form, 'a' can be a mix of terminals and nonterminals.
Example:

```
Consider Grammar : S -> aSa | bSb | ε

Derivation:              S => aSa => abSba => abbSbba => abbbba
```

Left Sentential and Right Sentential Form:

- A left-sentential form is a sentential form that occurs in the *leftmost derivation of some sentence.*
- A right-sentential form is a sentential form that occurs in the *rightmost derivation of some sentence.*

Handle contains two things:

- Production
- Position

Example:

```
S -> aABe

A -> Abc | b

B -> d
```

Steps:

```
abbcde : γ = abbcde , A->b; Handle = b
aAbcde : γ = RHS = aAbcde , A->Abc; Handle = Abc
aAde : γ = aAde , B->d; Handle = d
aABe : γ = aABe, S-> aABe; Handle = aABe
```

Note- *Handles are underlined in the right-sentential forms.*

Is the leftmost substring always handled?

No, choosing the leftmost substring as the handle always, may not give correct SR(Shift-Reduce) Parsing.

Handle Pruning:

Removing the children of the left-hand side non-terminal from the parse tree is called **Handle Pruning**.
A rightmost derivation in reverse can be obtained by handle pruning.

Steps to Follow:

- Start with a string of terminals 'w' that is to be parsed.
- Let w = γ_n, where γ_n is the nth right sequential form of an unknown RMD.
- To reconstruct the RMD in reverse, locate handle βn in γ_n. Replace βn with LHS of some $A_n \dashrightarrow$ βn to get $(n-1)^{th}$ RSF $\gamma_{n-1.}$ Repeat.

Example 1:

Right Sequential Form	Handle	Reducing Production
id + id * id	id	E ⇒ id
E + id * id	id	E ⇒ id
E + E * id	id	E ⇒ id
E + E * E	E + E	E ⇒ E + E
E * E	E * E	E ⇒ E * E
E (Root)		

Example 2:

Right Sequential Form	Handle	Production
id + id + id	id	E ⇒ id
E + id + id	id	E ⇒ id
E + **E** + id	id	E ⇒ id
E + **E** + **E**	**E** + **E**	E ⇒ E + E

Right Sequential Form	Handle	Production
E + E	**E + E**	E ⇒ E + E

E (Root)