

Name: Ansh Agrawal

Batch : A2

Roll No : 20

Practical No 5

**Aim: Write a program to validate a natural language sentence. Design a natural language grammar, compute and input the LL (1) table. Validate if the given sentence is valid or not based on the grammar.**

In [4]:

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grammar = {
    'S': ['NP VP'],
    'NP': ['P', 'PN', 'D N'],
    'VP': ['V NP'],
    'N': ['championship', 'ball', 'toss'],
    'V': ['is', 'want', 'won', 'played'],
    'P': ['me', 'I', 'you'],
    'PN': ['India', 'Australia', 'Steve', 'John'],
    'D': ['the', 'a', 'an']
}

parsing_table = {
    ('S', 'India'): ['NP VP'],
    ('S', 'me'): ['NP VP'],
    ('NP', 'India'): ['PN'],
    ('NP', 'me'): ['P'],
    ('NP', 'the'): ['D N'],
    ('VP', 'won'): ['V NP'],
    ('V', 'won'): ['won'],
    ('N', 'championship'): ['championship'],
    ('D', 'the'): ['the'],
    ('PN', 'India'): ['India'],
    ('PN', 'Australia'): ['Australia'],
    ('PN', 'Steve'): ['Steve'],
    ('PN', 'John'): ['John'],
}

def parse_input(input_string):
    stack = ['S']
    tokens = input_string.split()

    index = 0
    steps = []

    while stack:
        top = stack.pop()
        steps.append(f"Stack: {stack}, Tokens: {tokens[index:]}, Top: {top}")
```

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    if top in grammar:
        rule = parsing_table.get((top, tokens[index]), None)
        if rule:
            stack.extend(reversed(rule[0].split()))
        else:
            steps.append(f"Invalid step: No rule found for ({top}, {tokens[index]})")
            return steps, False
    elif top == tokens[index]:
        index += 1
    else:
        steps.append(f"Invalid step: Token mismatch. Expected '{top}', but got '{tokens[index]}'")
        return steps, False

    is_valid = index == len(tokens)
    return steps, is_valid

input_string = "India won the championship"

steps, is_valid = parse_input(input_string)

for step in steps:
    print(step)

print("Valid" if is_valid else "Invalid")

```

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Stack: [], Tokens: ['India', 'won', 'the', 'championship'], Top: S
Stack: ['VP'], Tokens: ['India', 'won', 'the', 'championship'], Top: NP
Stack: ['VP'], Tokens: ['India', 'won', 'the', 'championship'], Top: PN
Stack: ['VP'], Tokens: ['India', 'won', 'the', 'championship'], Top: India
Stack: [], Tokens: ['won', 'the', 'championship'], Top: VP
Stack: ['NP'], Tokens: ['won', 'the', 'championship'], Top: V
Stack: ['NP'], Tokens: ['won', 'the', 'championship'], Top: won
Stack: [], Tokens: ['the', 'championship'], Top: NP
Stack: ['N'], Tokens: ['the', 'championship'], Top: D
Stack: ['N'], Tokens: ['the', 'championship'], Top: the
Stack: [], Tokens: ['championship'], Top: N
Stack: [], Tokens: ['championship'], Top: championship
Valid

```

In [ ]: