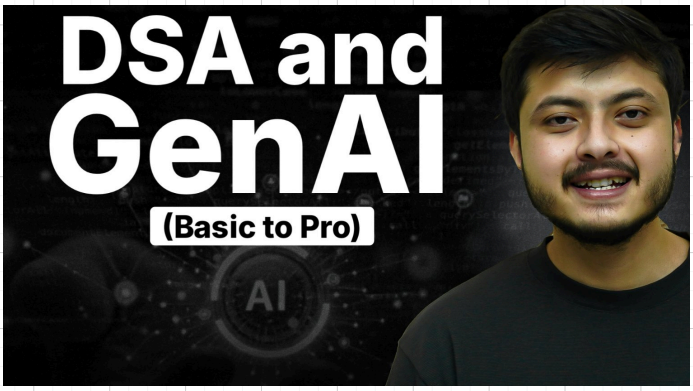


# DSA - 4

## Pattern 1:

```
1
0 1
1 0 1
0 1 0 1
1 0 1 0 1
```

```
for (int i = 1; i <= 5 ; i++) {
    bool num = i%2;
    for (int j = 1; j <= i ; j++) {
        cout<<num;
        num = ! num;
    }
    cout<<endl;
}
```

**Dry Run:**

```
i = 1
num = 1     (1%2)
j = 1
1 -> print

i = 2
num = 0     (2%2)
j = 1
0 -> print
num = 1
j = 2
1 -> print
```

## Pattern 2:

```
A
A B
A B C
A B C D
A B C D E
```

```
for (int i = 1; i <= 5 ; i++) {
    char c = 'A';
    for (int j = 1; j <= i ; j++) {
        cout<<c;
        c++;
    }
    cout<<endl;
}
```

**Dry Run:**

```
i = 1
c = 'A'
j = 1
    A -> print

i = 2
c = 'A'
j = 1
    A -> print
c++ = 65 + 1 -> B
c = 'B'
j = 2
    B -> print
```

## Pattern 3:

```
A
B B
C C C
D D D D
E E E E E
```

```
char c = 'A';
for (int i = 1; i <= 5 ; i++) {
    for (int j = 1; j <= i ; j++) {
        cout<<c;
    }
    c++;
    cout<<endl;
}
```

**Dry Run:**

```
c = 'A'
i = 1
j = 1
    A -> print
c++ = 65 + 1 -> B

c = 'B'
i = 2
j = 1 2
    B B -> print
```

## Pattern 4:

```
        1
      1 2 1
    1 2 3 2 1
  1 2 3 4 3 2 1
1 2 3 4 5 4 3 2 1
```

```
for (int i = 1; i <= 5; i++) {
    for (int j = 1; j <= 5-i ; j++) {
        cout<<" ";
    }
    for (int k = 1; k <= i; k++) {
        cout<<k;
    }
    for (int l = i-1 ; l >= 1; l--) {
        cout<<k;
    }
    cout<<endl;
}
```

**Dry Run:**

```
i = 1
j = 1 2 3 4 -> print spaces
k = 1 -> print

i = 2
j = 1 2 3 -> print spaces
k = 1 2 -> print
l = 1 -> print
```

## Program: Prime Number

```
if(num<2) {
    cout<<"Not Prime";
    return 0;
}
for(int i = 2; i < num; i++) {
    if(num%i == 0) {
        cout<<"Not Prime";
        return 0;
    }
}
cout<<"Prime Number";
```

**Algorithm:**

1. Start
2. Input number num
3. if num < 2, Print "Not Prime" and Stop
4. Initialize i = 2
5. Repeat loop while i < num
6. if num%i == 0, Print "Not Prime" and Stop
7. Increment i by 1
8. Print "Prime Number"
9. Stop

**Dry Run:**
num = 1
Not Prime -> print

num = 3
i = 2
3%2 = 0 -> false
Prime Number -> Print

**Why return 0 is used here?**
Exits the program immediately.

**break ->** only exits the loop

## while Loop:-

**Syntax:**

```
initialization
while (condition) {
    // code
    update;
}
```

**Example:**

```
int i = 1
while (i <= 10) {
    cout<<i<<" ";
    i++;
}
```

## Program: Sum of Digit

```
int num, rem, sum = 0;
cout<<"Enter the number";
cin>>num;
while(num) {
    rem = num%10;
    sum += rem;
    num /= 10;
}
cout<<sum;
```

**Algorithm:**

1. Start
2. Declare variables num, rem, and sum
3. Initialize sum = 0
4. Input number num
5. Repeat while num != 0
6. Find remainder rem=num%10
7. Add remainder to sum
8. Update number num=num/10
9. Print sum
10. Stop

**Dry Run:**
num = 354
rem = 354%10 -> 4
sum = 0 + 4 -> 4
num = 354/10 -> 35

num = 35
rem = 35%10 -> 5
sum = 4 + 5 -> 9
num = 35/10 -> 3

**while(num) ->** num is not equal to 0.