20.14. TIME COMPLEXITY CALCULATION
FOR LOOP (BASED ON FOR LOOP EXPRESSION).

EXPLANATION:

$for(intitialization; condition\ ; increment)\{\}$

$And\ we\ know\ for\ intitazation\ it\ can\ take\ more\ than\ 1\ variable\ ,$
$increment\ also\ more\ than\ 1\ but\ condtion\ will\ remain\ same.$

$for(i = 1, j = 1, s = 1 \dots . n\ no. of\ varaibles = 1;$
$i \leq n\&\&j \leq n||s \geq n \dots ;$
$i + +; j + +; s + +; \dots n\ no. of\ variable + +)$
$\{\dots\}$

$Hence\ in\ initialization\ we\ can\ take\ n\ no. of\ variables$
$seperated\ by\ , (comma).$

.

EXAMPLE 1

$$for(i = 1; j = 2; i \leq n \&\& j \leq n\ ; i++, j++)\{$$

$$k = k + 1;$$

$$\}$$

SOLUTION

$The\ above\ will\ take\ upper\ bound\ as\ 2\ and\ because\ of\ Anding$ $and\ will\ print\ k = k + 1\ , n - 2\ times.\ O(n - 2) = O(n).$

EXAMPLE 2

$$for(i = 1; j = 2; i \leq n || j \leq n\ ; i++, j++)\{$$

$$k = k + 1;$$

$$\}$$

SOLUTION

$j\ will\ run\ from\ 2\ to\ n + 2\ times\ and\ i\ run\ from$

$1\ to\ n\ times\ because\ of\ ORing$

$and\ k = k + 1\ will\ get\ printed\ 1\ to\ n\ times\ i.e.$

$$\sum_{i=1}^{n} 1 = (1 + 1 + 1 \dots . n \; times) = n \, , hence \; O(n)$$

EXAMPLE 3

$for(i = n; j = n + 1; i \geq 1 \&\& j \geq 1 \; ; i - -, j - -)\{$

$k = k + 1;$

}

SOLUTION

$Here \; n \; will \; be \; considered \; as \; upper \; bound \; and \; loop$

$will \; execute \; from \; 1 \; to \; n$

$\Longrightarrow k = k + 1 \; will \; be \; printed :$

$$\sum_{i=1}^{n} 1 = (1 + 1 + \cdots n \; times) = O(n)$$

EXAMPLE 4

$for(i = n; j = n + 1; i \geq 1 || j \geq 1\ ; i - -, j - -)\{$

$k = k + 1;$

}

SOLUTION

$Here\ n + 1\ will\ be\ considered\ as\ upper\ bound\ and\ loop$

$will\ execute\ from\ 1\ to\ n + 1$

$\Rightarrow k = k + 1\ will\ be\ printed:$

$$\sum_{i=1}^{n+1} 1 = (1 + 1 + \cdots (n + 1)\ times) = O(n + 1) = O(n)$$