GALGOTIAS UNIVERSITY

CAT I Semester III, V, VII, IX All Programs
Answer uploading Template

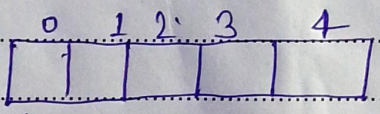
Admission No. of Student	21SCSE1011615	Name of Course	DSA
Name of Student	Abhinav kumar choudhary	Course Code	BCSE 2361
Program	B.Tech-CSE	Date of Examination	27/09/2022
Semester	Third	Time	11:00-12:30
Signature of Student	Abhinav kumar chy		

Student shall start writing from below:

Ans 1) An array is a collection of elements of the same type placed in contiguous memory locations that can be reffered by using an index to a unique identifier

for example

int A[5]



A sparsh matrix is a matrix whose most of the elements are zero.

Ans → 2) Applications of stack are following

→ Evaluation of Arithmetic expression

→ Backtracking

→ Delimiter checking

→ Reverse a data

→ Processing function calls.

Ans ③

Data Structure is the way of storing data in computer's memory so that it can be used easily and efficiently.

Operations performed on different data structure:

(i) Transversing :-

Transvessing a data structure means to visit the element stored in it.

(ii) Searching :-

Searching means to find a particular element in the given data structure.

(iii) Insertion :-

Insertion means to add an element in the given data structure.

(iv) Deletion :-

Deletion means to delete an element in the given data structure.

(v) Create :-

It reverses memory for program elements by declaring them. The creation of data structure can be done during

(i) compile-time

(ii) Run-time

ns→ ④ Tower of Hanoi is a mathematical puzzle where we have three rods (A, B & C) & N disks. Initially, all the disks are stacked in decreasing value of diameter. The objective of the puzzle is to move the entire stack to another rod, obeying the following simple rules:

(i) Only one disk can be moved at a Time

(ii) Each move consist of taking the upper disk from one of the stack & placing it on the top of another stack (i.e a disk can only be removed if it is uppermost disk of the stack).

(iii) No disk may be placed on top of a smaller disk

For example:—

input - 2

output:-

Disk 1 - ~~removed~~ moved from A to B

Disk 2 - moved from A to C

Disk 3 - moved from B to C

Ans→5) Algorithm is a step-by-step procedures which defines a set of instruction to be executed in a certain order to get the desired output. Some important categories of algorithms are:- Search, Sort, Insert, update, Delete.

Asymptotic Notations are languages that allow us to analyse an algorithms running time by identifying its behaviour as the input size for the algorithms increases. It is mathematical notation used to describe the running Time of an algorithms.

There are mainly three asymptotic notations:-

(i) Big-O Notation (O-notations):-

Big-O notation represents the upper bound of the running time of an algorithm Thus, it gives the worst-case complexity of algorithms.

Expression:-

$O(g(n)) = \{f(n)$: there exist positive constant such that $0 \leq f(n) \leq cg(n)$ for all $n \geq n_0\}$

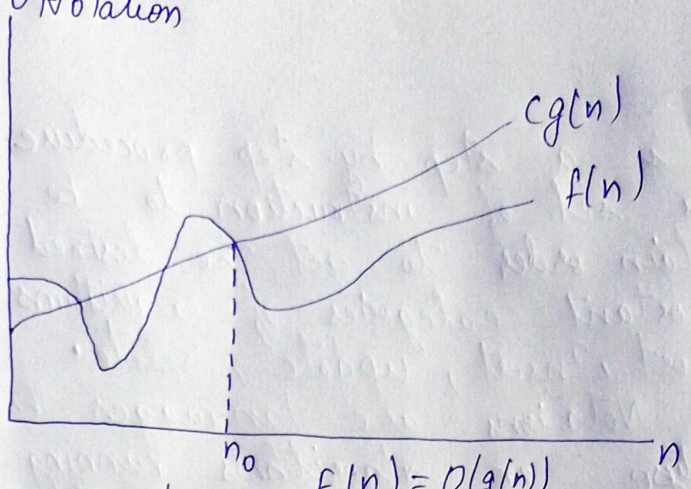
(ii) Omega Notation (Ω-notation):-

Omega notation represents the lower bound of the running Time of an algorithms. Thus, it provides the best case complexity of an algorithms.

Expression:-

$\Omega(g(n)) = \{f(n)$: there exist +ve constant c & n_0 such that $0 \leq cg(n) \leq f(n)$ for all $n \geq n_0\}$

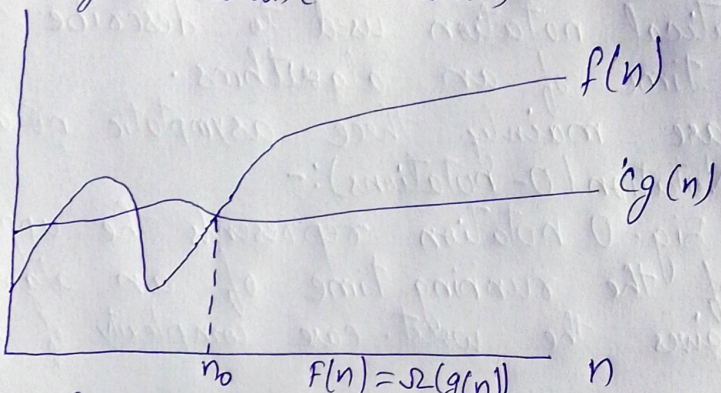
(i) Big-O Notation



$f(n) = O(g(n))$

Big-O gives upper bound of a function

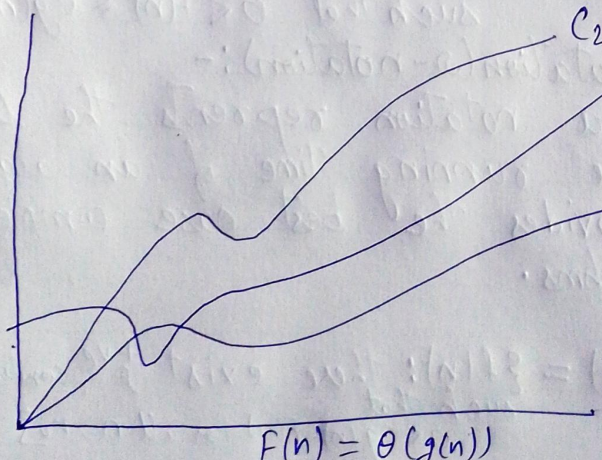
(ii) Omega Notation (Ω-notation)



$f(n) = \Omega(g(n))$

Omega gives the lower bound of a function

(iii) Theta notation :-



$f(n) = \theta(g(n))$

Theta bounds the function within constant factors.

Example:- (Ω notations):-

$\{(n^2+n), (2n^2), (n^2+\log(n))\}$ belongs to $\Omega(n^2)$

$\cup \{n/4, (2n+3), (n/100 + \log n)\}$ belongs to $\Omega(n)$

$\cup \{100, \log(2000), 10^4\}$ belongs to $\Omega(1)$

(iii) Theta Notations (Θ-notations):-

It incloses the function from above & below. since it represents the upper & lower bound of the running time of an algorithms. it is used to analyze average-case complexity of an algorithms.

$\Theta(g(n)) = \{f(n)$: there exist positive constant such that $0 \le c_1 g(n) \le f(n) \le c_2 g(n)$ for all $n \ge n_0\}$

ex—

$\{100, \log(2000), 10^4\}$ belongs to $\Theta(1)$

$\{(n^2+n), (2n^2), (n^2+\log(n))\}$ belongs to $\Theta(n^2)$

$\{(n/4), (2n+3), (n/100 + \log(n))\}$ belongs to $\Theta(n)$

6) Algorithm for PUSH operations :-

PUSH (STACK, TOP, SIZE, ITEM)

Step 1: if TOP >= N-1 then

PRINT "stack is overflow"

Exit

End of if

Step 2:- TOP = TOP + 1

Step 3:- STACK[TOP] = ITEM

Step 4:- Return

Algorithms for POP operation

PUSH (STACK, TOP, ITEM)

Step 1: IF TOP = 0 then

PRINT "Stack is empty"

Exit

End of if

Step 2: ITEM = STACK [POP]

Step 3: TOP = TOP - 1

Step 4: Return

Steps:-

① Push "(" onto stack, and add ")" to the end of X.

② Scan X from left to right & repeat step 3 to 6 for each element of X until the stack is empty

③ If an operand is encountered, add it to Y.

④ If a left parenthesis is encountered, push it onto the stack.

5) If an operator is encountered, then

(i) Repeatedly pop from stack & add to Y each operator which has same as or the higher precedence than operator

6) If a right parenthesis is encountered then

(i) Repeatedly pop from stack & add to Y each operator

② Remove the left parenthesis

⑦ End