

Subject AOA

Assignment #01

Q11

Answer

Algorithm An algorithm is a formal definition with some specific characteristics that describes a process. An algorithm is a set of steps of operation:

e.g. Selection sort (Algorithm)

input → A list L of integers of length n .

output → A sorted list $L1$ containing in L .

Steps

- 1) Find the minimum value in the list L .
- 2) Swap it with the value in the current position
- 3) Repeated this process for all the element until the entire list is sorted.
- 4) Return the sorted list $L1$.
- 5) Stop

Pseudocode is an informal and human readable description of an algorithm leaving many details of it. Writing a pseudocode has no restriction of styles and its only objectives is to describe the high level steps of algorithm.

Pseudocode: Selection Sort

for $j \leftarrow 1$ to $n-1$

$\text{smallest} \leftarrow j$

 for $i \leftarrow j+1$ to n

 if $A[i] < A[\text{smallest}]$

$\text{smallest} \leftarrow i$

 exchange $A[j] \leftrightarrow A[\text{smallest}]$

Q#02

Ans: Big O:

Big O notation is used to describe the complexity of an algorithm when measuring its efficiency, which in this case means how well the algorithm scales with the size of the data set.

Ways of Big O

i) $O(1)$: Time complexity of a function is considered as $O(1)$ if it does not contain loop, recursion.

e.g. def swap(s_1, s_2):

return s_2, s_1

ii) $O(n)$: Time complexity of a loop is considered as $O(n)$ if the loop variable is increment/decrement by a constant amount.

e.g.

for i in range(1, n, c):

print(i) $\therefore n, c$ both constant

iii) $O(n^c)$:

$\therefore n$ variable

Time complexity of nested loops is equal to the number of times the innermost statement is executed.

e.g. $O(n^2)$

for i in range(1, n, c):

expression

for j in range(1, n, c):

expression

print(i, j)

iv) $O(\log n)$: Time complexity of a loop is considered as $O(\log n)$ if the loop variable is divided/multiplied by a constant amount.

e.g.

$i = 2$

while $i \leq n$:

$\therefore n$ variable

print(i)

$\therefore c$ is constant.

$i = i * c$

v) $O(\log \log n)$: Time complexity of a loop is considered as $O(\log \log n)$ if the loop variable is reduced/increased exponentially by a constant.

e.g. $i = 2$

while $i \leq n$:

 Print(i)

$i = i^{1.5}$

Q31 Answer:

Algorithm of Selection Sort

input: A list L of integers length n .

output: A sorted list $L1$

Steps

- 1) Find the minimum value in list L
- 2) Swap it with the value in the current position.
- 3) Repeat this process for all the elements until the entire list is sorted.
- 4) Return the sorted list $L1$
- 5) Stop

Pseudocode

for $j \leftarrow 1$ to $n-1$

 smallest $\leftarrow j$

 for $i \leftarrow j+1$ to n

 if $A[i] < A[\text{smallest}]$

 smallest $\leftarrow i$

 exchange $A[j] \leftrightarrow A[\text{smallest}]$

Q#04 Find Time Complexity

a) Ans:

$$T.C = O(n)$$

b) Ans:

$$T.C = O(\log n)$$

c) Ans:

$$T.C = O(\log n^2)$$

e) Ans:

$$T.C = O(n^2)$$