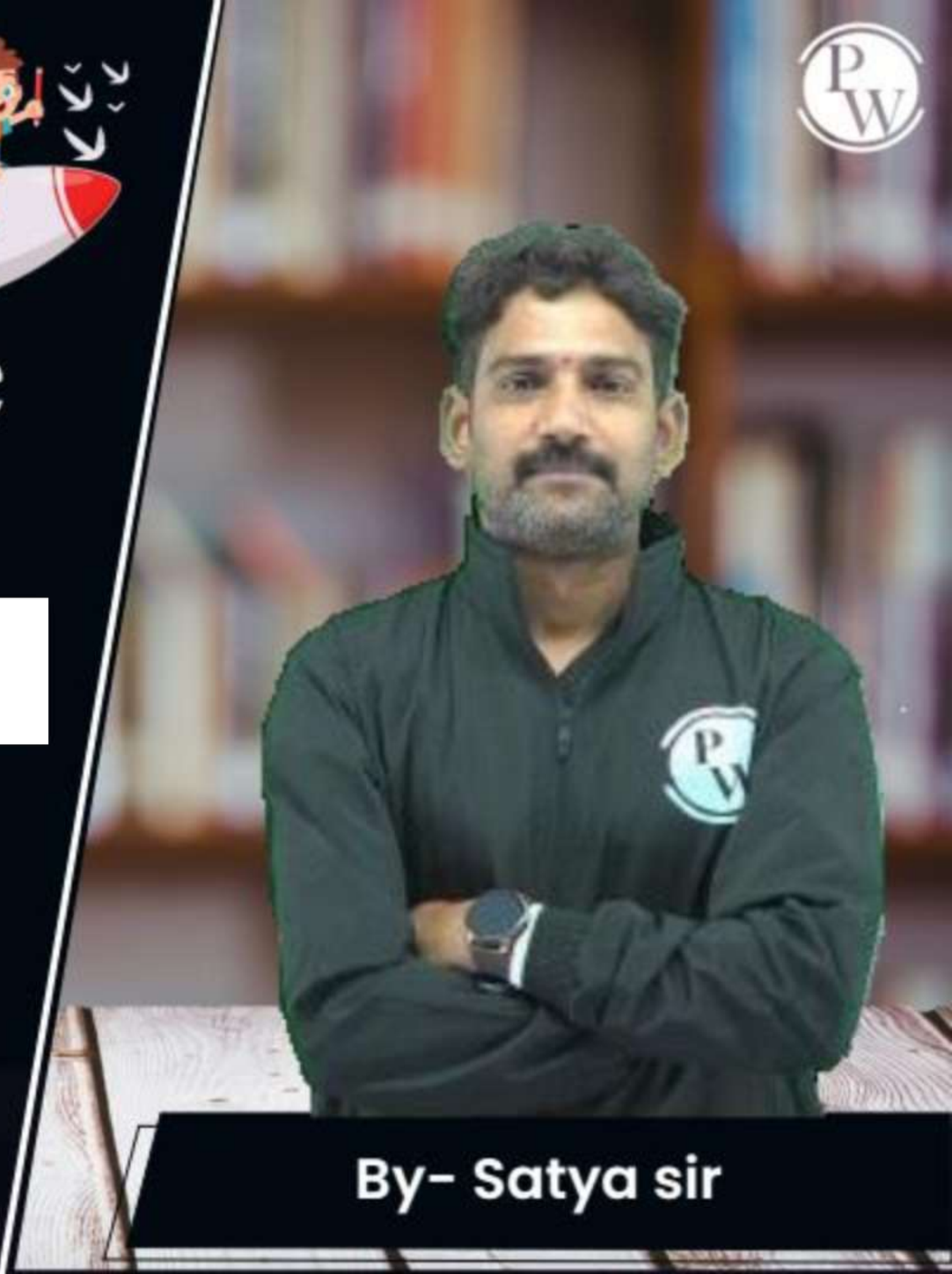
Data Science & Artificial Intelligence

Data Structure through Python

Super 1500+

Lecture No.- 02



By- Satya sir

Topics to be Covered

Stack DS

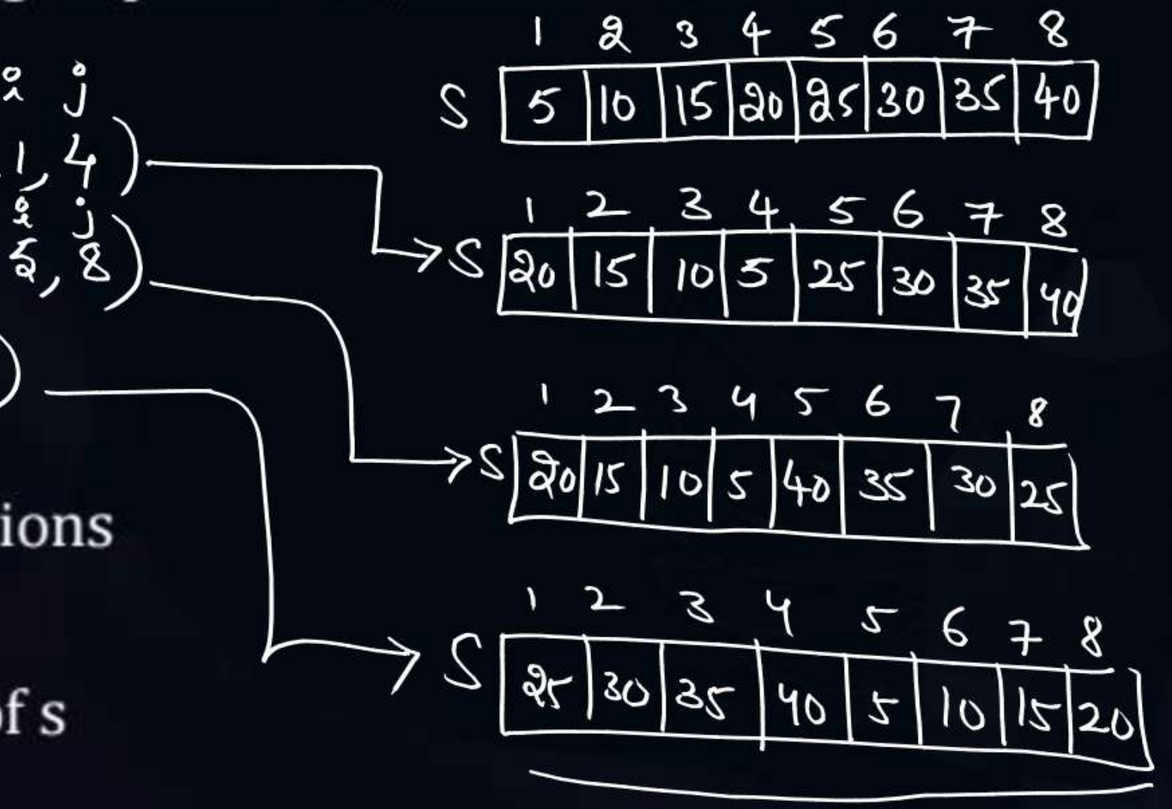
- Applications of Stack
  - Expression Evaluation
  - Expression Conversion
- Stack Permutations
- Stack operations

SUPER 1500+ - DSP- CLASS – 1 - Homework Question - 1

#Q. Suppose you are given an array s[1..n] and a procedure reverse (s, i, j) which reverses the order of elements in a between positions i and j (both inclusive). What does the following sequence do, where 1 <= k <= n:

reverse(s, 1, k) ;
reverse(s, k + 1, n);
reverse(s, l, n);

reverse(S, 1, 4)
reverse(S, 5, 8)
reverse(S, 1, 8)



Let n=8
i=1
K=4
j=8

A. Rotates s left by k positions
B. Leaves s unchanged
C. Reverses all elements of s
D. None of the above

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$i = [0 \text{ to } 9] \quad j = [0 \text{ to } 3]$

#Q. Consider a 2-dimensional array x with 10 rows and 4 columns, with each element storing a value equivalent to the product of row number and column number.

The array row major format. If the first element x[0][0] occupies the memory location with address 1000 and each element occupies only one memory location, which all locations (in decimal) will be holding a value of 10 ?

A. 1018, 1019
B. ✓ 1022, 1041
C. 1013, 1014
D. 1000, 1399

$a[i][j] = i * j$

$i * j = 10$

$(i=1, j=10)$ X, $(i=10, j=1)$ X, $(i=2, j=5)$ X, $(i=5, j=2)$

$\&a[10][1] = 1000 + [(10*4)+1]*1 = 1041$

Start Row index

$\&a[i][j] = B + [(i-x)*C + j]*n$

$\&a[5][2] = 1000 + [(5-0)*4+2]*1$

$= 1000 + 22 = 1022$

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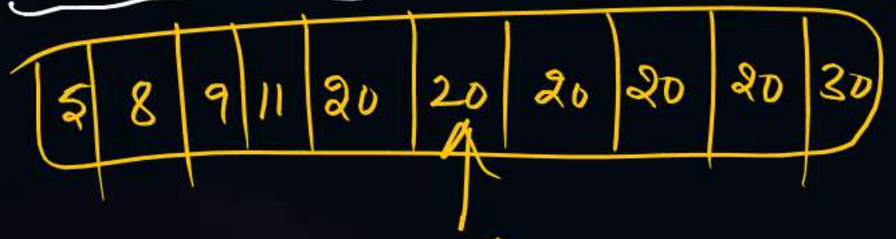
#Q. The minimum number of comparisons required to determine if an integer appears more than n/2 times in a sorted array of n integers is

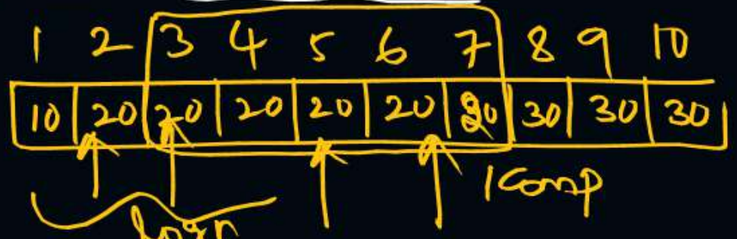
A. Θ(n)

B. Θ(logn)

C. Θ(n*logn)

D. Θ(1)





$n=10 \Rightarrow$ number appears more than $\frac{n}{2}$ times $\Rightarrow \frac{10}{2} = 5$ times

$\Rightarrow \geq 6$ times

find a number 20 appeared more than 5 times or not.

Compare with mid element.

$\text{Total comp}^{\min} = \lfloor \log_2 n \rfloor + 1 \Rightarrow O(\log_2 n)$

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#Q. Consider the following declaration of a two dimensional array in C:

~~char a[100][100];~~

Assuming that the main memory is byte-addressable and that the array is stored starting from memory address 0, the address of a [40][50] is :

A. 4040

~~B.~~ 4050

C. 5040

D. 5050

Python

a = [[ ] ,] 100 Rows, 100 Cols ; Each Element Size 1 Byte.

$(i-x)$ when $x=0$ $\Rightarrow i$

$\&a[i][j] = B + [i*c+j]*n$

$= 0 + [40*100+50]*1$

$= 4050$

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#Q. Consider the following two Python code segments. Y and X are one and two dimensional arrays of size n and n × n respectively, where 2 ≤ n ≤ 10. Assume that in both code segments, elements of Y are initialized to 0 and each element X[i][j] of array X is initialized to i + j. Further assume that when stored in main memory all elements of X are in same main memory page frame.

Code segment 1:

```
for i in range(n):
    y[i] + = X[0][i];
```

Code segment 2:

```
for i in range(n):
    y[i] + = X[i][0];
```

Let n=3

Y

0	1	2
0	0	0

CS1:

Y[0] = 0 + X[0][0] = 0

Y[1] = 0 + X[0][1] = 1

Y[2] = 0 + X[0][2] = 2

n×n = 3×3

X

i \ j	0	1	2
0	0	1	2
1	1	2	3
2	2	3	4

Y

0	1	2
0	0	0

CS2:

Y[0] = 0 + X[0][0] = 0

Y[1] = 0 + X[1][0] = 1

Y[2] = 0 + X[2][0] = 2

X

i \ j	0	1	2
0	(0)	1	2
1	(1)	2	3
2	(2)	3	4

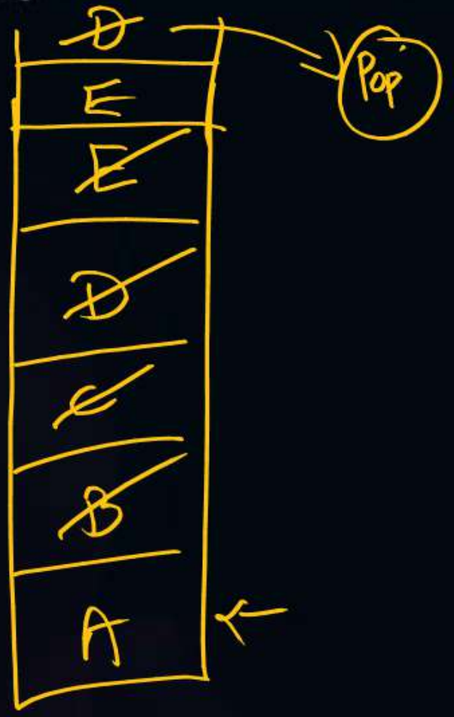
Which of the following statements is/are correct?

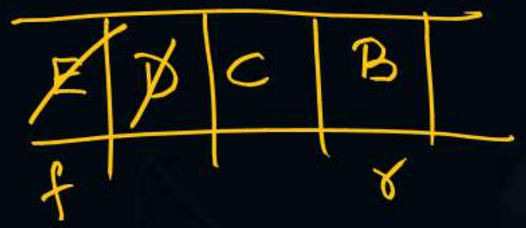
S1: Final contents of array Y will be same in both code segments.
S2: Elements of array X accessed inside the for loop shown in code segment 1 are contiguous in main memory.
S3: Elements of array X accessed inside the for loop shown in code segment 2 are contiguous in main memory.

(A) Only S2 is correct
(B) Only S3 is correct
(C) Only S1 and S2 are correct
(D) Only S1 and S3 are correct

#Q. The five items: A, B, C, D, and E are pushed in a stack, one after other starting from A. The stack is popped four items and each element is inserted in a queue. The two elements are deleted from the queue and pushed back on the stack. Now one item is popped from the stack. The popped item is

a. A
b. B
c. C
d. D





#Q. Consider infix expression a+b-c+d*e/f*g+h/i-j and the precedence, associativity as given below:

Operator	Priority	Associativity
-	1	Right To Left
*	2	Left To Right
+	3	Right To Left
/	4	Right To Left

Default
1) ^
2) *, /
3) +, -
L To R

The Postfix Expression is

Stack | + | - | + | * | / | * | + | / | -

Pop Pop Pop Pop Pop Pop Pop Pop Pop

y: abc-de*++fg*h+ij-//

The Prefix Expression:

Pop Pop Pop Pop Pop Pop

y: ji-hgf*+/ed*cb-+a+/

Prefix: /+a+-bc*de/+*fgh-ij

#Q. . A function f defined on stacks of integers satisfies the following properties.
f(empty) = 0 and f(push(S, i)) = min(f(S), 0) + $(i)^2$ for all stacks S and integers i.

If a stack S contains the integers 4, –5, 7, –3, 6 in order from bottom to top, what is f(S)?

i =

f(S) 0 16 25 49 9 36

$f(Push(S,4)) = \min(0,0) + (4)^2 = 0 + 16 = 16$

$f(Push(S,-5)) = \min(16,0) + (-5)^2 = 0 + 25 = 25$

$f(Push(S,7)) = \min(25,0) + (7)^2 = 0 + 49 = 49$

$f(Push(S,-3)) = \min(49,0) + (-3)^2 = 0 + 9 = 9$

$f(Push(S,6)) = \min(9,0) + (6)^2 = 0 + 36 = 36$

ANS: 36

final stack

#Q. Let ' s' be a stack and push and pop be functions implementing the Insertion and Deletion operations in a Stack. push takes 2 parameters: the stack and the element to be inserted , pop takes a single parameter: the stack. What will be the contents of the stack after the following operations: push(s,A), push(s,B), push(s,C), pop(s), pop(s), push(s, D), push (s, E), pop(s) ?

A. A D

B. D E

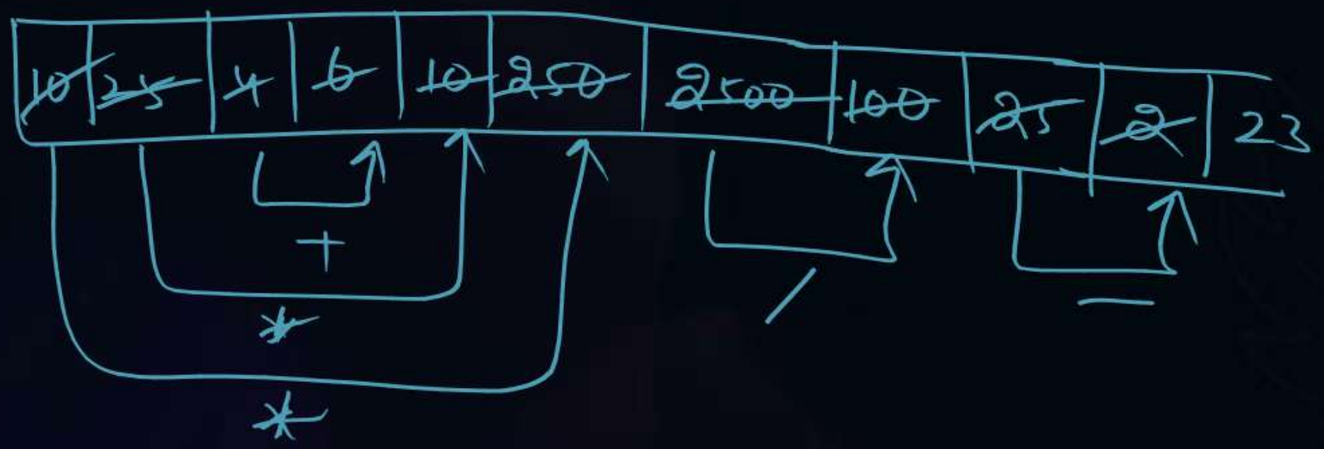
C. C E

D. A E

#Q. The Result after evaluating the Postfix Expression:

10 25 4 6 + * * 100 / 2 – is _____

A. 21 B. 23 C. 25 D. 27



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ANS:

#Q. Which of the following permutation(s) can be obtained in the same order using a stack assuming that input is the sequence 5, 6, 7, 8, 9 in that order?

(A) 7, 8, 9, 5, 6

(B) 5, 9, 6, 7, 8

(C) 7, 8, 9, 6, 5 Push(5) Push(6) Push(7) Pop Push(8) Pop(), Push(9), Pop, Pop, Pop

(D) 9, 8, 7, 5, 6

MSQ

#Q. The Result after evaluating the Prefix Expression:

/ * / * / * / 100 9 80 7 60 5 40 3 is _____

H/W

A. 60000
B. 7500
C. 25000
D. 20000

#Q. The Prefix Expression for an infix expression (A*B+C)/(D-(E*F)) is

A. +*/ABC-D*EF

B. +/*ABC-D*EF

C. /*+ABC-D*EF

D. /+*ABC-D*EF

Hw

#Q. The postfix form of the expression is (A+B) * (C*D-E)*F/G is

A. AB+CD*E-FG/**
B. AB+CD*E-*F*G/
C. AB+CD*E-F**G/
D. AB+CDE*-*F*G/

H/W

#Q. Consider the array implementation of stack:

If the array index starts with 0, the maximum value of top which does not cause stack overflow is?

#/ω

A) 8
B) 9
C) 10
D) 11

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#Q. The Postfix Expression for an infix expression a+b*(c^d-e)^(f+g*h)-i is

A. abcd^e-fgh*+^*+i-

B. abcd^e*-fgh*+^+i-

C. abcd^e-*fgh+^*+i-

D. abcd^e-fgh+^**+i-

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#Q. The result after evaluating the postfix Expression 20 50 3 6 + * * 300 / 2 – is ___

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#Q. The following postfix expression with single digit operands is evaluated using a stack:

8 2 3 ^ / 2 3 * + 5 1 * -

Note that ^ is the exponentiation operator. The top two elements of the stack after the first * is evaluated are:

(A) 6, 1

(B) 5, 7

(C) 3, 2

(D) 1, 5

2 mins Summary

- Stack
  - Applications
  - Operations

NEXT CLASS TOPIC: QUEUES AND HASH TABLES

THANK - YOU