Southern Technical University
Technical Institute / Qurna
Dep. of Computer Systems Techniques

Second class
Subject : Data Structures
Lecturer : Israa Mahmood Hayder
Lecture no.3

المكدس (Stack)

- الاسبوع - الثاني عشر- الثالث عشر –

الثاني عشر-الثالث عشر	* المكدس Stack. - تمثيل المكدس باستخدام المصفوفة Array representation of stack. - المكدس الموصول linked stack. - خوارزميات عمليات المكدس. - تطبيقات المكدس.

B// Rationale (مبررات الوحدة) :-

In this unit, the student will learn how to update and search for items in stacks and its applications in your programs.

C// Central Ideas (الفكرة المركزية):-

- Operations on Stacks
- Update operation algorithm (CHANGE)
- Search operation algorithm (PEEP)
- Applications on stacks
- linked stack

D// Objectives (أهداف الوحدة):-

After studying this unit, the student will be able to:-

- Write Update operation algorithm and Program (CHANGE)
- Write Search operation algorithm and Program (PEEP)

- learn about some the stack applications.
- learn operations on linked stack

Operations on Stacks:

3) Search (PEEP) : Search for the i'th element from top

Algorithm PEEP;

If (top-I+1<= 0) then write "error Underflow"
Else
Item ← stack (top-I+1)

End PEEP

4) UPDATE : Change the i'th element from top

Algorithm UPDATE;
If (top-I+1<= 0) then write "error Underflow"
Else
Stack (top-I+1) ← item
End UPDATE

3-Applications on the Stacks:

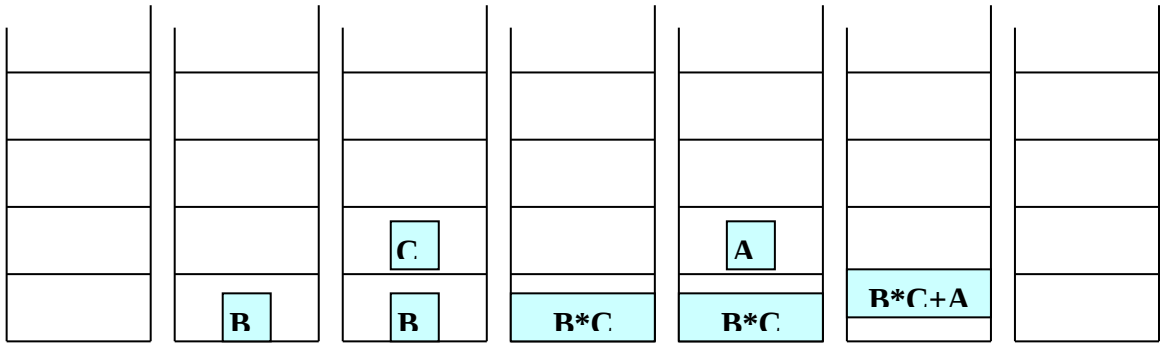
1- In life :A pile of dishes on your kitchen counter.

2- In computer:

a) In Stack machines:

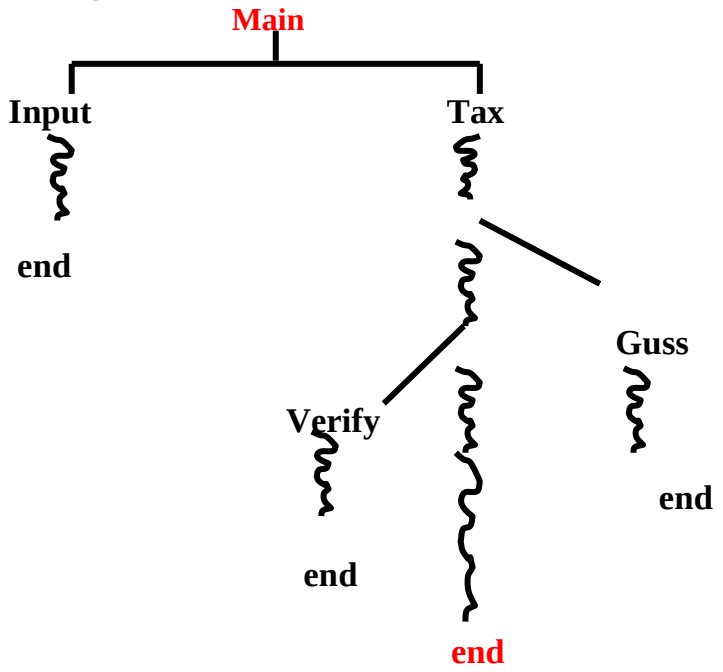
Ex:

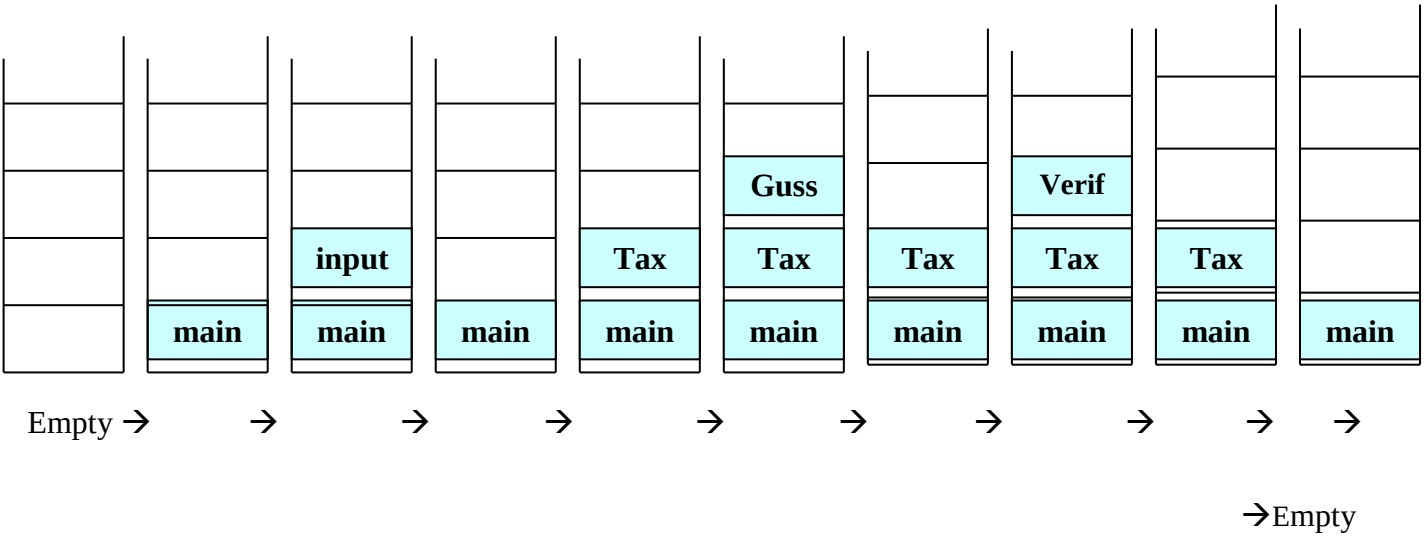
A=B*C+A
PUSH B
PUSH C
MUL
PUSH A
ADD
POP A



Empty push B push C mul push A add pop a

B) In programming:





1- In Recurtion:

$$Fact(N) = \begin{cases} 1 if N = 0 \\ N * Fact(N-1) otherwise \end{cases}$$

2- In Polish Notation:

Three ways to write expressions:

- Infix notation (oprand1- operator - oprand2)
  Ex: 5+9 or a+b

- Prefix notation (operator - oprand1 - oprand2) /polish notation
  Ex: +59 or +ab

- Postfix notation (oprand1- oprand2 - operator) /reverse polish notation
  Ex: 95+ or ab+

Priority of operations:

0- (
1- ^, (-), (+), not (-,+ are sign of number)
2- *, /, and, div, mod
3- +, -, or
4- =, <, >, <>, <=, >=
5-)

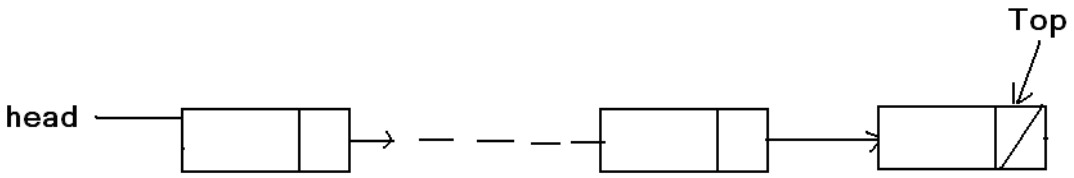
Examples:

Infix	postfix	prefix
a+b	ab+	+ab
a*(b+c)	abc+-	*a+bc
a*b*c	ab*c*	**abc

Quiz1: Write the algorithm to update an item in the stack

Quiz2: 1-use stack machine to execute the equation B=(A+B)/(C-D)
2- write (a+b/3)-5 in postfix form

Linked Stack is like the single linked list but the insertion and deletion will be only occure at the end of the stack.



Operation on linked stack:-

1- Push item :- (do not need to check the over flow)

Algorithm :-

```
new (p) ;
top.next=p;
read(top.data);
top=p;
p=nil;
end push
```

2- Pop item :-

Algorithm :-

```
p=star;
if   top=nil  then "under flow"
else
   while p.next < > top do
        p= p.next
end if
item  ← top.data
delete (top);
top = p
end pop;
```

References:

1- Data Structures Demystified, by Jim Keogh and Ken Davidson, ISBN:0072253592, McGraw-Hill/Osborne © 2004

2- هياكل البيانات / الطبعة الثانية، تاليف د.عصام الصفار،اصدارات السفير للنشر/ بغداد، ٢٠٠١

-الحقيبة التعليمية مادة "هياكل البيانات "، اعداد : نفارت الياس يوسف ،المعهد التقني كركوك