

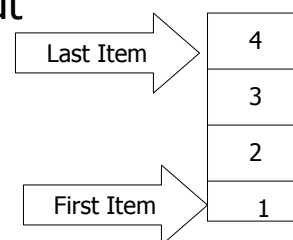
Data Structures

Stack

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Introduction

- Stack: is a data structure that is particularly useful in applications involving reversing.
- LIFO : Last In First Out



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Stack Implementation

- Stack can be implemented in two different ways:
 1. Contiguous stack: the stack is implemented as an array.
 2. Linked stack: pointers and dynamic memory allocation is used to implement the stack.

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3



Stack in STL

- STL : Standard Template Library.
- Stack is implemented as a class in STL and we can use it directly in our applications.
- In our course we will learn how can we build a class stack like that in STL.

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4



Example: stack in STL

```
#include<iostream>
#include<stack>
using namespace std;
main()
{
    int n;
    double item;
    stack<double> numbers;
    cin>>n;
    for(int i=0; i<n ; i++)
    {
        cin>> item;
        numbers.push(item);
    }
}
```

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5



Cont...

```
for( i=0;i<n;i++)
{
    cout<<numbers.top();
    numbers.pop();
}
```

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6



Stack operations

- Push: insert a new item into the stack.
- Pop: delete an item from the stack.
- Top: retrieve an item from the top of the stack.
- Empty: check if the stack is empty or not.



Important concepts

- Generics: the ability to use the same underlying data structure and operation for different entry type.
- Generic methods in C++ :
 - Typedef
 - Template



Cont..

- Error handling: provide information about error when it is detected.
- Exception handling: technique that when the error is detected an exception can be thrown.



Cont..

- Information Hiding: using methods of the data structure without knowing how it is implemented.



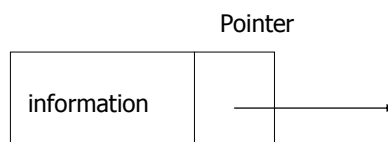
Node and Type declaration

- Node: is the basic unit in the linked structure.
- Node components:
 - Information
 - Pointer: that telling us where to find the next node.



Cont..

- We are using structure rather than class to build node because the default case in structure is public.





Node Implementation

```
typedef int Node_entry;  
Struct Node  
{  
    Node_entry data;  
    Node* next;  
    Node();  
    Node(Node_entry item,Node *link=NULL);  
};
```

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13



Cont..

- The problem in this definition is circularity in definition.
- C++ allows just pointer type to be used in type definition.

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14



Node Constructors

```
Node::Node()
{
    next = NULL;
}
Node::Node(Node_entry item,Node*link)
{
    data = item;
    next = link;
}
```



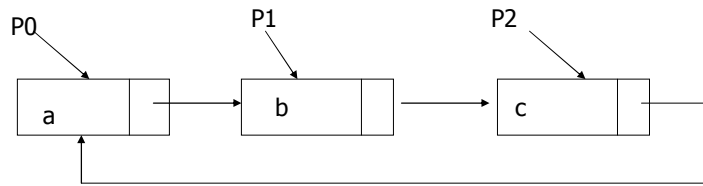
Examples

Draw the result of the following statements:

```
Node first_node('a');
Node *P0 = &first_node;
Node *P1= new Node('b');
P0→next = P1;
Node *P2 = new Node ('C',P0);
```


Cont..

Answer:



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17

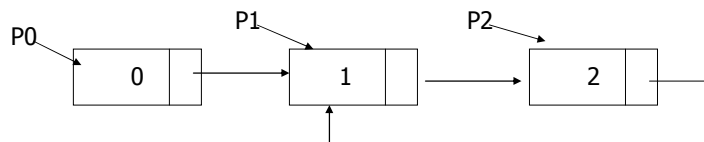
Example

Draw the result of the following statements:

```
Node *P0 = new Node('0');
```

```
Node *P1 = P0->next=new Node('1');
```

```
Node *P2= P1->next = new Node('2',P1);
```



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18

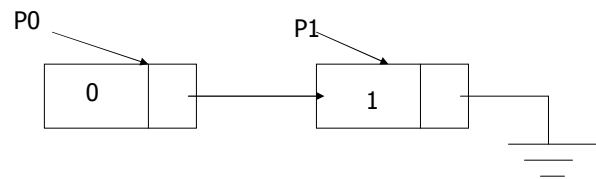


Example

Draw the result of the following statements:

```
Node *P0 = new Node('0');
```

```
Node *P1 = P0->next = new Node('1');
```



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19



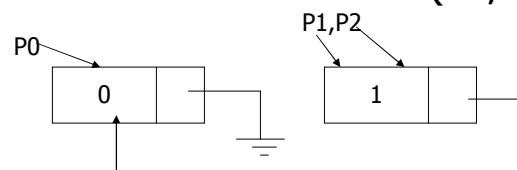
Example

Draw the result of the following statements:

```
Node *P0 = new Node('0');
```

```
Node *P1,*P2;
```

```
P1 = P2 = new Node('1',P0);
```



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20

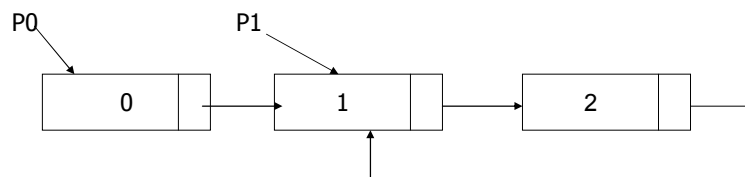
Example

Draw the result of the following statements:

```
Node *P0 = new Node('0');
```

```
Node *P1 = P0→next = new Node('1');
```

```
P1→ next = new Node('2',P1);
```



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21

Class Stack

```
Typedef int stack_entry;
```

```
Class stack
```

```
{
```

```
public:
```

```
stack();
```

```
bool empty() const;
```

```
bool pop();
```

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22



Cont...

```
bool push(const Node_entry &item);  
bool top(Node_entry &item);  
private:  
Node *top_node;  
};
```