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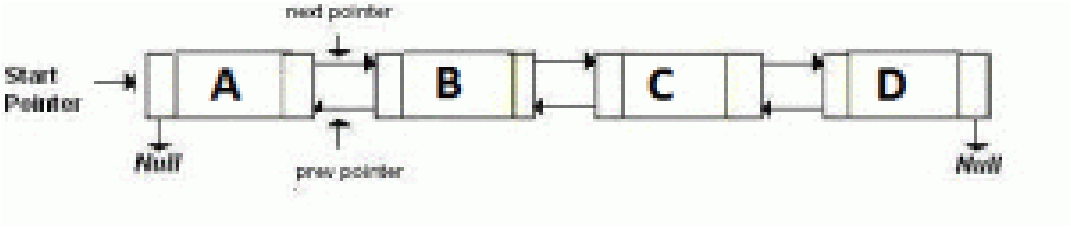
XOR Linked List – A Memory Efficient Doubly Linked List | Set 1

An ordinary Doubly Linked List requires space for two address fields to store the addresses of previous and next nodes. A memory efficient version of Doubly Linked List can be created using only one space for address field with every node. This memory efficient Doubly Linked List is called XOR Linked List or Memory Efficient as the list uses bitwise XOR operation to save space for one address. In the XOR linked list, instead of storing actual memory addresses, every node stores the XOR of addresses of previous and next nodes.



Consider the above Doubly Linked List. Following are the Ordinary and XOR (or Memory Effiecient) representations of the Doubly Linked List.

Ordinary Representation:
Node A:
prev = NULL, next = add(B) // previous is NULL and next is address of B

Node B:
prev = add(A), next = add(C) // previous is address of A and next is address of C

Node C:
prev = add(B), next = add(D) // previous is address of B and next is address of D

Node D:
prev = add(C), next = NULL // previous is address of C and next is NULL

XOR List Representation:
Let us call the address variable in XOR representation npx (XOR of next and previous)

Node A:
npx = 0 XOR add(B) // bitwise XOR of zero and address of B

Node B:
npx = add(A) XOR add(C) // bitwise XOR of address of A and address of C

Node C:
npx = add(B) XOR add(D) // bitwise XOR of address of B and address of D

Node D:
npx = add(C) XOR 0 // bitwise XOR of address of C and 0

Traversal of XOR Linked List:
We can traverse the XOR list in both forward and reverse direction. While traversing the list we need to remember the address of the previously accessed node in order to calculate the next node's address. For example when we are at node C, we must have address of B. XOR of add(B) and *npx* of C gives us the add(D). The reason is simple: npx(C) is "add(B) XOR add(D)". If we do xor of npx(C) with add(B), we get the result as "add(B) XOR add(D) XOR add(B)" which is "add(D) XOR 0″ which is "add(D)". So we have the address of next node. Similarly we can traverse the list in backward direction.

We have covered more on XOR Linked List in the following post.

[XOR Linked List – A Memory Efficient Doubly Linked List | Set 2]

References:
http://en.wikipedia.org/wiki/XOR_linked_list
http://www.linuxjournal.com/article/6828?page=0,0

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devil • 5 months ago
Good havens, does anyone ever code in Java here. !crying
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devil ➝subhin • 5 months ago
http://cocoadev.com/wiki/Desig... Some explanation. Just incorporate this in your LL implementation.
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devil ➝subhin • 5 months ago
Don't worry. I am going to try and come up with it here. Hold on..
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Atul • 2 years ago
Somehow I didn't like the "node* next" in the given source code. Since it is the distance between the locations, why can't it be a simple number? Hence I implemented following.

```
 #include <stdio.h>
#include <stdlib.h>



typedef struct node
{
```

```
  int val;
  unsigned int pnx;  /* prev, next ptr XOR'ed value */
} NODE;
NODE *head, *tail;



/* returns XORed value of the node addresses */
```

see more

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Sudha • 2 years ago

// Insertion, Deletion and Both direction traversal.

#include
#include

struct node
{
int num;
struct node *ptrdiff;
};

void insert(struct node**,struct node**,struct node*,struct node*);
void displayForward(struct node*,struct node*);
void displayBackward(struct node*,struct node*);
struct node* newnode(int);
struct node *XOR(struct node *, struct node *);
void delete_node(struct node **,struct node **,int);

int main()

see more

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code1234 ➝Sudha • 5 months ago

Works very well! Great, thanks! :)

• Reply • Share ›

raj • 2 years ago

/* */
[#include

```
[#include
#include
typedef struct node
{
int data;
struct node *npx;
}node;
void createlist(node **p)
{
node *prev=NULL,*next,*current;
int i,j,n,x;
current=*p;
while(1)
{
printf("\nWant to add a node then give 1 else 0 : ");
scanf("%d",&n);
if(n!=1)
{
if(current==NULL)
```

see more

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Avatar

Yogesh • 2 years ago

But we always need the prev node address in order to traverse from a given node pointer. Its more like a single linked list where we rem the prev node of a current node ptr.

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Avatar

kevindra • 3 years ago

I think there is something wrong with formatting of code. It's taking "" as >

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GeeksforGeeks ➝kevindra • 3 years ago

@kevindra: There seems to be some issue with formatting. We will look into this issue. As a temporary fix, we have updated the code with pre tags and the code is readable.

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Avatar

kevindra • 3 years ago

```
#include < iostream >



using namespace std;



struct node{
  int v;
  node *next;
```

```
};
node *start = NULL;
node *end = NULL;
```

see more

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Avatar

kevindra • 3 years ago

Here is the working code for insertion and traversal (both directions) in XOR linked list:

```
#include <iostream>

using namespace std;

struct node{
  int v;
  node *next;
};
```

see more

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Avatar

ktanay • 3 years ago

//minor typo
npx = add(A) XOR add(C) // bitwise XOR of address of A and address of B

// bitwise XOR of address of A and address of C

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GeeksforGeeks ↛ktanay • 3 years ago

@ktanay: Thanks for pointing this out. We have corrected the typo.

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Avatar rajcools • 3 years ago

we are able to save memory but per node time of execution is increasing!!!! time - space tradeoff

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kl ➦ rajcools • 3 years ago

```
struct b
{
int a;
int b;
};
```

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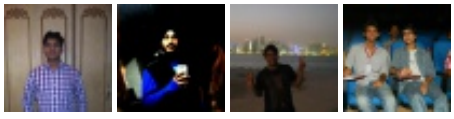

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