
Arbre binari. Calcula arbre amb factors d'equilibri**X34743_ca**

Donada la classe *Abin* que permet gestionar arbres binaris usant memòria dinàmica, cal implementar el mètode

```
void arbre_factors_equilibri ();
```

que modifica el contingut de l'arbre per tal de guardar a cada node el factor d'equilibri (diferència entre l'altura del fill esquerra i l'altura del fill dret).

Cal enviar a jutge.org la següent especificació de la classe *Abin* i la implementació del mètode dins del mateix fitxer.

```
include <cstdlib>
#include <iostream>
using namespace std;
typedef unsigned int nat;

template <typename T>
class Abin {
public:
    Abin(): _arrel (NULL) {};
    // Pre: cert
    // Post: el resultat és un arbre sense cap element
    Abin(Abin<T> &ae, const T &x, Abin<T> &ad);
    // Pre: cert
    // Post: el resultat és un arbre amb un element i dos subarbres

    // Les tres grans
    Abin(const Abin<T> &a);
    ~Abin();
    Abin<T>& operator=(const Abin<T>& a);

    // operador ii d'escriptura
    template <class U> friend std::ostream& operator<<(std::ostream&, const Abin<U> &a);

    // operador jj de lectura
    template <class U> friend std::istream& operator>>(std::istream &, Abin<U> &a);

    // Modifica el contingut de l'arbre per tal de guardar a cada node el factor
    // d'equilibri (diferència entre l'altura fill esquerra i l'altura fill dret).
    void arbre_factors_equilibri ();

private:
    struct node {
        node* f_esq ;
        node* f_dret ;
        T info ;
    };
}
```

```

node* _arrel ;
static node* copia_nodes (node* m);
static void esborra_nodes (node* m);
static void print_nodes (node* m, ostream &os, string d1);

// Aquí va l'especificació dels mètodes privats addicionals
};

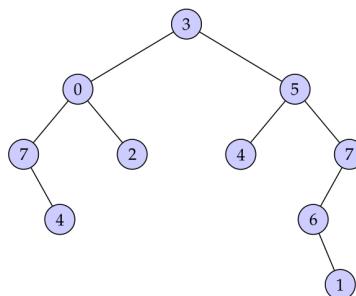
// Aquí va la implementació del mètode arbre_factors_equilibri

```

Per testejar la solució, jutge.org ja té implementats la resta de mètodes de la classe *Abin* i un programa principal que llegueix un arbre binari i després crida el mètode *arbre-factors-equilibri*.

Entrada

L'entrada consisteix en la descripció d'un arbre binari d'enters (el seu recorregut en preordre, en el qual inclou les fulles marcades amb un -1). Per exemple, l'arbre (mira el PDF de l'enunciati)



es descriuria amb

3 0 7 -1 4 -1 -1 2 -1 -1 -1 5 4 -1 -1 7 6 -1 1 -1 -1 -1

Sortida

El contingut de l'arbre binari abans i després de cridar el mètode *arbre-factors-equilibri*.

Observació

Només cal enviar la classe requerida i la implementació del mètode *arbre-factors-equilibri*. Pots ampliar la classe amb mètodes privats. Segueix estrictament la definició de la classe de l'enunciati.

Exemple d'entrada 1

7 5 -1 -1 8 9 -1 -1 4 6 -1 -1 3 -1 -1

Exemple de sortida 1

```

[7]
 \__[8]
 |   \__[4]
 |   |   \__[3]
 |   |   |   \__.
 |   |   |   \__.
 |   |   \__[6]
 |   |   \__.
  
```

```

|     |
|     \__ [9]
|           \
|           \__ .
|
\__ [5]           \
                  \__ .
                  \__ .

```

[-2]

```

\__ [-1]
|   \__ [0]

```

Exemple d'entrée 2

3 0 7 -1 4 -1 -1 2 -1 -1 5 4 -1 -1 7 6 -1

```
graph TD; 0 --- 1; 0 --- 2; 1 --- 3; 1 --- 4; 2 --- 5; 2 --- 6; 3 --- 7; 3 --- 8; 4 --- 9; 4 --- 10;
```

Exemple de sortida 2

```
graph TD; Root[-1] --- Node1[-2]; Node1 --- Node2[2]; Node1 --- Node3["."]; Node2 --- Node4["-1"]; Node2 --- Node5[0]; Node3 --- Node6["0"]; Node3 --- Node7["."]; Node4 --- Node8[0]; Node4 --- Node9["."]; Node5 --- Node10["0"]; Node5 --- Node11["."]; Node6 --- Node12["0"]; Node6 --- Node13["."]; Node7 --- Node14["-1"]; Node7 --- Node15[0]; Node7 --- Node16["."]; Node8 --- Node17["0"]; Node8 --- Node18["."]; Node9 --- Node19["-1"]; Node9 --- Node20[0]; Node9 --- Node21["."]; Node10 --- Node22["0"]; Node10 --- Node23["."]; Node11 --- Node24["0"]; Node11 --- Node25["."]; Node12 --- Node26["0"]; Node12 --- Node27["."]; Node13 --- Node28["0"]; Node13 --- Node29["."]; Node14 --- Node30["0"]; Node14 --- Node31["."]; Node15 --- Node32["0"]; Node15 --- Node33["."]; Node16 --- Node34["0"]; Node16 --- Node35["."]; Node17 --- Node36["0"]; Node17 --- Node37["."]; Node18 --- Node38["0"]; Node18 --- Node39["."]; Node19 --- Node40["0"]; Node19 --- Node41["."]; Node20 --- Node42["0"]; Node20 --- Node43["."]; Node21 --- Node44["0"]; Node21 --- Node45["."]; Node22 --- Node46["0"]; Node22 --- Node47["."]; Node23 --- Node48["0"]; Node23 --- Node49["."]; Node24 --- Node50["0"]; Node24 --- Node51["."]; Node25 --- Node52["0"]; Node25 --- Node53["."]; Node26 --- Node54["0"]; Node26 --- Node55["."]; Node27 --- Node56["0"]; Node27 --- Node57["."]; Node28 --- Node58["0"]; Node28 --- Node59["."]; Node29 --- Node60["0"]; Node29 --- Node61["."]; Node30 --- Node62["0"]; Node30 --- Node63["."]; Node31 --- Node64["0"]; Node31 --- Node65["."]; Node32 --- Node66["0"]; Node32 --- Node67["."]; Node33 --- Node68["0"]; Node33 --- Node69["."]; Node34 --- Node70["0"]; Node34 --- Node71["."]; Node35 --- Node72["0"]; Node35 --- Node73["."]; Node36 --- Node74["0"]; Node36 --- Node75["."]; Node37 --- Node76["0"]; Node37 --- Node77["."]; Node38 --- Node78["0"]; Node38 --- Node79["."]; Node39 --- Node80["0"]; Node39 --- Node81["."]; Node40 --- Node82["0"]; Node40 --- Node83["."]; Node41 --- Node84["0"]; Node41 --- Node85["."]; Node42 --- Node86["0"]; Node42 --- Node87["."]; Node43 --- Node88["0"]; Node43 --- Node89["."]; Node44 --- Node90["0"]; Node44 --- Node91["."]; Node45 --- Node92["0"]; Node45 --- Node93["."]; Node46 --- Node94["0"]; Node46 --- Node95["."]; Node47 --- Node96["0"]; Node47 --- Node97["."]; Node48 --- Node98["0"]; Node48 --- Node99["."]; Node49 --- Node100["0"]; Node49 --- Node101["."]; Node50 --- Node102["0"]; Node50 --- Node103["."]; Node51 --- Node104["0"]; Node51 --- Node105["."]; Node52 --- Node106["0"]; Node52 --- Node107["."]; Node53 --- Node108["0"]; Node53 --- Node109["."]; Node54 --- Node110["0"]; Node54 --- Node111["."]; Node55 --- Node112["0"]; Node55 --- Node113["."]; Node56 --- Node114["0"]; Node56 --- Node115["."]; Node57 --- Node116["0"]; Node57 --- Node117["."]; Node58 --- Node118["0"]; Node58 --- Node119["."]; Node59 --- Node120["0"]; Node59 --- Node121["."]; Node60 --- Node122["0"]; Node60 --- Node123["."]; Node61 --- Node124["0"]; Node61 --- Node125["."]; Node62 --- Node126["0"]; Node62 --- Node127["."]; Node63 --- Node128["0"]; Node63 --- Node129["."]; Node64 --- Node130["0"]; Node64 --- Node131["."]; Node65 --- Node132["0"]; Node65 --- Node133["."]; Node66 --- Node134["0"]; Node66 --- Node135["."]; Node67 --- Node136["0"]; Node67 --- Node137["."]; Node68 --- Node138["0"]; Node68 --- Node139["."]; Node69 --- Node140["0"]; Node69 --- Node141["."]; Node70 --- Node142["0"]; Node70 --- Node143["."]; Node71 --- Node144["0"]; Node71 --- Node145["."]; Node72 --- Node146["0"]; Node72 --- Node147["."]; Node73 --- Node148["0"]; Node73 --- Node149["."]; Node74 --- Node150["0"]; Node74 --- Node151["."]; Node75 --- Node152["0"]; Node75 --- Node153["."]; Node76 --- Node154["0"]; Node76 --- Node155["."]; Node77 --- Node156["0"]; Node77 --- Node157["."]; Node78 --- Node158["0"]; Node78 --- Node159["."]; Node79 --- Node160["0"]; Node79 --- Node161["."]; Node80 --- Node162["0"]; Node80 --- Node163["."]; Node81 --- Node164["0"]; Node81 --- Node165["."]; Node82 --- Node166["0"]; Node82 --- Node167["."]; Node83 --- Node168["0"]; Node83 --- Node169["."]; Node84 --- Node170["0"]; Node84 --- Node171["."]; Node85 --- Node172["0"]; Node85 --- Node173["."]; Node86 --- Node174["0"]; Node86 --- Node175["."]; Node87 --- Node176["0"]; Node87 --- Node177["."]; Node88 --- Node178["0"]; Node88 --- Node179["."]; Node89 --- Node180["0"]; Node89 --- Node181["."]; Node90 --- Node182["0"]; Node90 --- Node183["."]; Node91 --- Node184["0"]; Node91 --- Node185["."]; Node92 --- Node186["0"]; Node92 --- Node187["."]; Node93 --- Node188["0"]; Node93 --- Node189["."]; Node94 --- Node190["0"]; Node94 --- Node191["."]; Node95 --- Node192["0"]; Node95 --- Node193["."]; Node96 --- Node194["0"]; Node96 --- Node195["."]; Node97 --- Node196["0"]; Node97 --- Node197["."]; Node98 --- Node198["0"]; Node98 --- Node199["."]; Node99 --- Node200["0"]; Node99 --- Node201["."];
```

Exemple d'entrada 3

-1

Exemple de sortida 3

.

.

Exemple d'entrada 4

3 -1 -1

Exemple de sortida 4

[3]

__.

__.

[0]

__.

__.

Exemple d'entrada 5

3 2 -1 -1 -1

Exemple de sortida 5

[3]

__.

__[2]

__.

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[1]

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__[0]

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__.

Exemple d'entrada 6

3 -1 2 -1 -1

Exemple de sortida 6

[3]

__[2]

| __.

| __.

__.

[-1]

__[0]

| __.

| __.

__.

Exemple d'entrada 7

-3 -2 -1 -1 -4 -1 -1

Exemple de sortida 7

[-3]

__[-4]

| __.

| __.

__[-2]

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[0]

__[0]

| __.

| __.

__[0]

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Informació del problema

Autor : Jordi Esteve
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