README

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1. 使用的程式語言 : C++(9.4.0)

```
reki0000@DESKTOP-A9V6HM5:/mnt/c/Users/reki/Desktop/資料庫/hw5$ g++ --version
g++ (Ubuntu 9.4.0-1ubuntu1~20.04.1) 9.4.0
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This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

reki0000@DESKTOP-A9V6HM5:/mnt/c/Users/reki/Desktop/資料庫/hw5$
```

2. 如何操作程式

(1)編譯與執行

到達makefile所在的檔案資料夾後，輸入make即可編譯，輸入make run執行程式，輸入make clean可刪除執行檔

(2)輸入order
進入程式後會先需要輸入order，如果樹建立成功就會出現下圖結果

```
Enter the order of B+Tree : 2
A B+Tree with order 2 , capacity 4 is built.
----------------------------------------------------------------
Enter "help" for usage.
Enter "display" to display the whole tree.
Enter "insert n" to insert number n.
Enter "insert-r n" to insert number n with redistribution.
Enter "bulk" for bulk loading.
Enter "delete n" to delete number n.
Enter "find a b" to list all numbers between a and b(where a<b).
Enter "restart" to delete current tree and build a new one.
Enter "quit" for quit.
----------------------------------------------------------------
```

接著會出現簡單的使用說明，下面我會針對每一項一一說明

```
Enter "help" for usage.
Enter "display" to display the whole tree.
Enter "insert n" to insert number n.
Enter "insert-r n" to insert number n with redistribution.
Enter "bulk" for bulk loading.
Enter "delete n" to delete number n.
Enter "find a b" to list all numbers between a and b(where a<b).
Enter "restart" to delete current tree and build a new one.
Enter "quit" for quit.
```

(3)help
在選擇mode時輸入help可以查看簡略的說明

(4)display
在選擇mode時輸入display可以印出現在tree的樣子

(5)insert
在選擇mode時輸入insert n可以將數字n insert到現在的tree裡面，並印出現在tree的樣子

(6)quit
在選擇mode時輸入quit離開程式

3. bonus

(7)insert-r
在選擇mode時輸入insert-r n可以使用有redistribution的insert

(8)bulk
在選擇mode時輸入bulk代表接下來將會輸入一串數字，並以這串數字做bulk loading，注意這串數字必須要以-1作為結束，代表該串數字已輸入完畢

```
Enter mode : bulk
Please use number -1 for the end of sequence.
Please enter a sequence of numbers: 1 2 3 4 6 7 -1
(3:_:_:_)
    [1,2,_,_]
    [3,4,6,7]
```

該功能應該只在一個空的樹上使用，否則會刪除現有的樹建立一個新的樹(order相同)

```
Enter mode : bulk 1 2 3 4 6 7 -1
Please use number -1 for the end of sequence.
Please enter a sequence of numbers: (3:_:_:_)
    [1,2,_,_]
    [3,4,6,7]
Enter mode : bulk
Doing bulk loading now will delete current tree and build a new one, are you sure to continue? (y/n)
y
A  new B+Tree with order 2 , capacity 4 is built.
Please use number -1 for the end of sequence.
Please enter a sequence of numbers: ▌
```

(8)delete
在選擇mode時輸入delete n可以刪除數字n，並印出tree現在的樣子

```
Enter mode : delete 14
(12:_:_:_)
    [10,11,_,_]
    [12,13,15,_]

Enter mode : ▌
```

(9)find a b
在選擇mode時輸入find a b，會列出這顆中a-b之間的所有數字
例如輸入find 1 4會輸出tree中1-4之間的所有數字

```
(3:_:_:_)
    [1,2,_,_]
    [3,4,6,7]
Enter mode : find 1 4
2 3
Enter mode : ▌
```

(10)restart
在選擇mode時輸入restart後，會重新輸入order並建立一個全新的樹

(11)遇到相同data的處理
如果輸入tree中已經存在的數字，該數字不會重複輸入

```
Enter mode : insert 12
12 is already in the B+Tree.
(12:_:_:_)
     [10,11,_,_]
     [12,13,15,_]

Enter mode : █
```

#4 參考資料
建立一個class BPlusTree來記錄整個樹的想法是參考下面的網站
B-tree | Programiz
https://www.programiz.com/dsa/b-tree

insert部分的實作有參考hw5.pdf後面附上的pseudo code