Data Structure Homework 13

繳交期限： 2020/1/19 17:00 前

補交期限(7 折)： 2020/1/26 17:00 前

手寫題：

在以下題目中，凡是說要比較的題目請比較 Collisions 即可。

4. Repeat Exercise 3 using a linked list method for collisions. Compare the results in this exercise with the results you obtained in Exercise 3.

6. Repeat Exercise 5 using a linked list method for collisions. Compare the results in this exercise with the results you obtained in Exercise 5.

8. Repeat Exercise 7 using a key-offset method for collisions. Compare the results in this exercise with the results you obtained in Exercise 7.

12. Repeat Exercise 11 using a key-offset method for collisions. Compare the results in this exercise with the results you obtained in Exercise 11.

手寫題參考：

以下為關聯的題目，非作業題目。

3. Using the modulo-division method and linear probing, store the keys shown below in an array with 19 elements. How many collisions occurred? What is the density of the list after all keys have been inserted?

```
224562 137456 214562
140145 214576 162145
144467 199645 234534
```

5. Repeat Exercise 3 using the digit-extraction method (first, third, and fifth digits) and quadratic probing.

7. Repeat Exercise 3 using the midsquare method, with the center two digits, for hashing. Use a pseudorandom-number generator for rehashing if a collision occurs. Use a = 3 and c = –1 as the factors.

11. Repeat Exercise 3 using the rotation method for hashing. First rotate the far-right digits two to the left and then use digit extraction (first, third, and fifth digits). Use the linear probe method to resolve collisions.

程式題：

19. Write a program that uses a hashing algorithm to create a list of inventory parts and their quantities sold in the past month. After creating the hashed list, write a simple menu-driven user interface that allows the user to select from the following options:

    a. Search for an inventory item and report its quantity sold
    b. Print the inventory parts and their quantities sold
    c. Analyze the efficiency of the hashing algorithm

    The parts data are contained in a text file, as shown in Table 13-4. The key is the three-digit part number. The quantity represents the units sold during the past month.

Part number	Quantity
112	12
130	30
156	56
173	17
197	19
150	50
166	66
113	13
123	12
143	14
167	16
189	18
193	19
117	11
176	76

TABLE 13-4 Data for Hashing Problem

Three outputs are required from your program.

a. Test the following searches and return appropriate messages. You may test other part numbers if you desire, but the following tests must be completed first:
   - Search for 112
   - Search for 126
   - Search for 173

b. When requested, analyze the efficiency of the hashing algorithm for this set of data. Your printout should follow the report format shown below.

```
Percentage of Prime Area Filled:xx%
Average nodes in linked lists:  nn
Longest linked list             nn
```

c. The printout of the entire contents of the list should use the following format:

```
Home Addr   Prime Area    Overflow List
   0          130/30
   1
   2          112/12
   3          123/12      143/14, 173/17, 193/19
   .
   .
   .
```

說明：

本題同學可使用除了 direct hashing 以外的任何 hashing 的方式來將 key (part number)轉換為 home address，且可使用任何資料結構來儲存 home address (ex:

array、linked list…)，但一律使用 linked list 的方式來處理 collision，並且 home address size 可自訂，但必須小於 part number 的總數 (表示一定會發生 collision)；另外處理 collision 的 linked list 長度也必須小於 part number 的總數 (表示不可以讓所有的 key 都 mapping 到同一 address)。

Input：

請將 input file 命名為 13_19_input.txt，其中每一行(row)為一筆資料，每筆資料格式為 part number 和 quantity，中間以空白隔開 (請參考附檔 13_19_input.txt 的格式)，並且 13_19_input.txt 最後不會多一個換行("\n")。測試時的資料為 20 筆，part number 為 0~999 不重複的整數；quantity 為 0~99 可能重複的整數。

Output：

請實作一個 menu-driven user interface，並讓使用者輸入選擇的功能(1~4，必須能重複輸入)，然後將結果印在螢幕上：

1. Searching：讓使用指輸入 part number 並尋找，找到則印出 address 及 quantity；沒找到則印出 part number not found
2. Print efficiency：
   (1) Percentage of prime area filled = $\frac{\text{有使用的 home address數}}{\text{總 home address 數}} * 100\%$
   (2) Average nodes in linked lists = 平均的 overflow list 長度 (不包含 prime area)
   (3) Longest linked list = 最大 overflow list 長度 (不包含 prime area)
3. Print entire content：印出所有資料的儲存情況，每筆資料表示為 part number/quantity
4. Exit

以下為 output 格式範例：

```
Please input command: 1
Searching: 112
Found part number 112 at home address 2, quantity: 12
Please input command: 2
Efficiency:
Percentage of Prime Area Filled: 50%
Average nodes in linked lists: 2
Longest linked list: 3
Please input command: 3
Home addr       Prime Area      Overflow List
0               130/30
1
2               112/12
3               123/12          143/14, 173/17, 193/19
.
.
.
Please input command: 4
Exit Program
```

評分標準：

1. 測試 3 筆 searching (1 筆 1 分，共 3 分)
2. 資料儲存方式有使用 hashing (2 分)
3. 資料儲存完整 (1 分)
4. 依據資料的儲存內容，3 項 efficiency 正確 (1 項 1 分，共 3 分)
5. 程式無法執行則只給 1 分
6. input file 名稱錯誤 (扣 1 分)
7. 輸出格式錯誤 (扣 1 分)
8. 檔名請命名為 “學號_13_19.c” / “學號_13_19.cpp” 繳交上傳 e3 ，請確認檔案正確，檔名錯誤不予計分，且不接受交錯檔案補交。
9. 抄襲 0 分