Javascript 雑湊表(HashTable)

JS hashtable.js > HashTable > search > slot

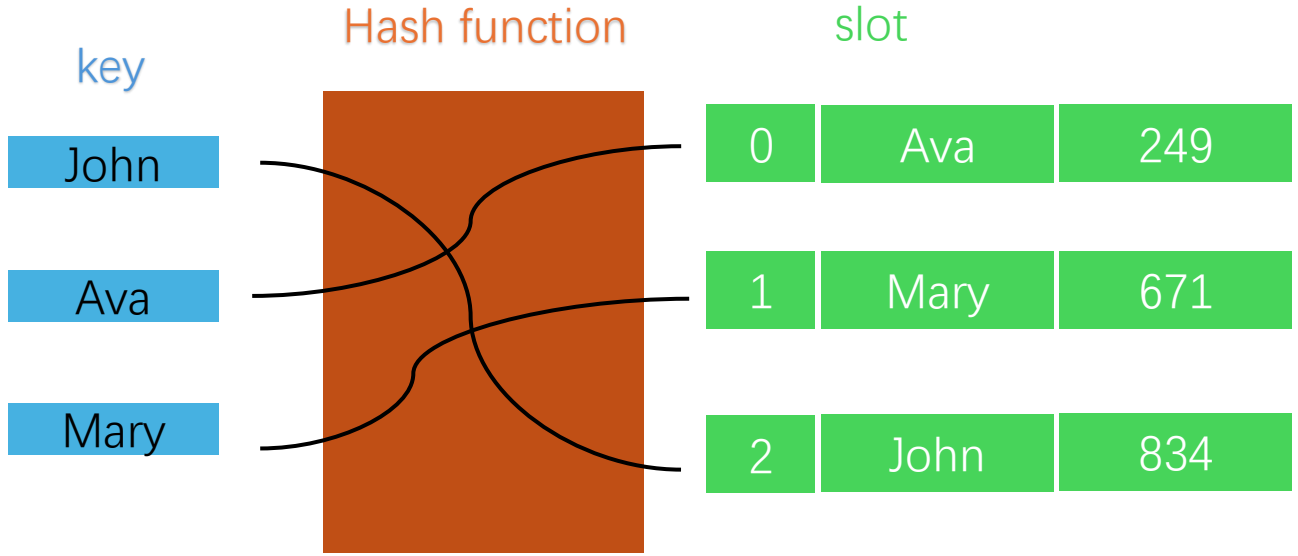
```
function hash(key, size) {
    let hashCode = 0;
    for (let index in key) {
      hashCode += key.charCodeAt(index);
    }
    return hashCode % size;
}

class Box {
    constructor(key,value) {
        this.key=key;
        this.value=value;
    }
}

class HashTable {
    constructor() {
      this.size = 16;
      this.slots = new Array(this.size).fill(null);
      this.length = 0;
    }
```

這個程式是雜湊表(HashTable)

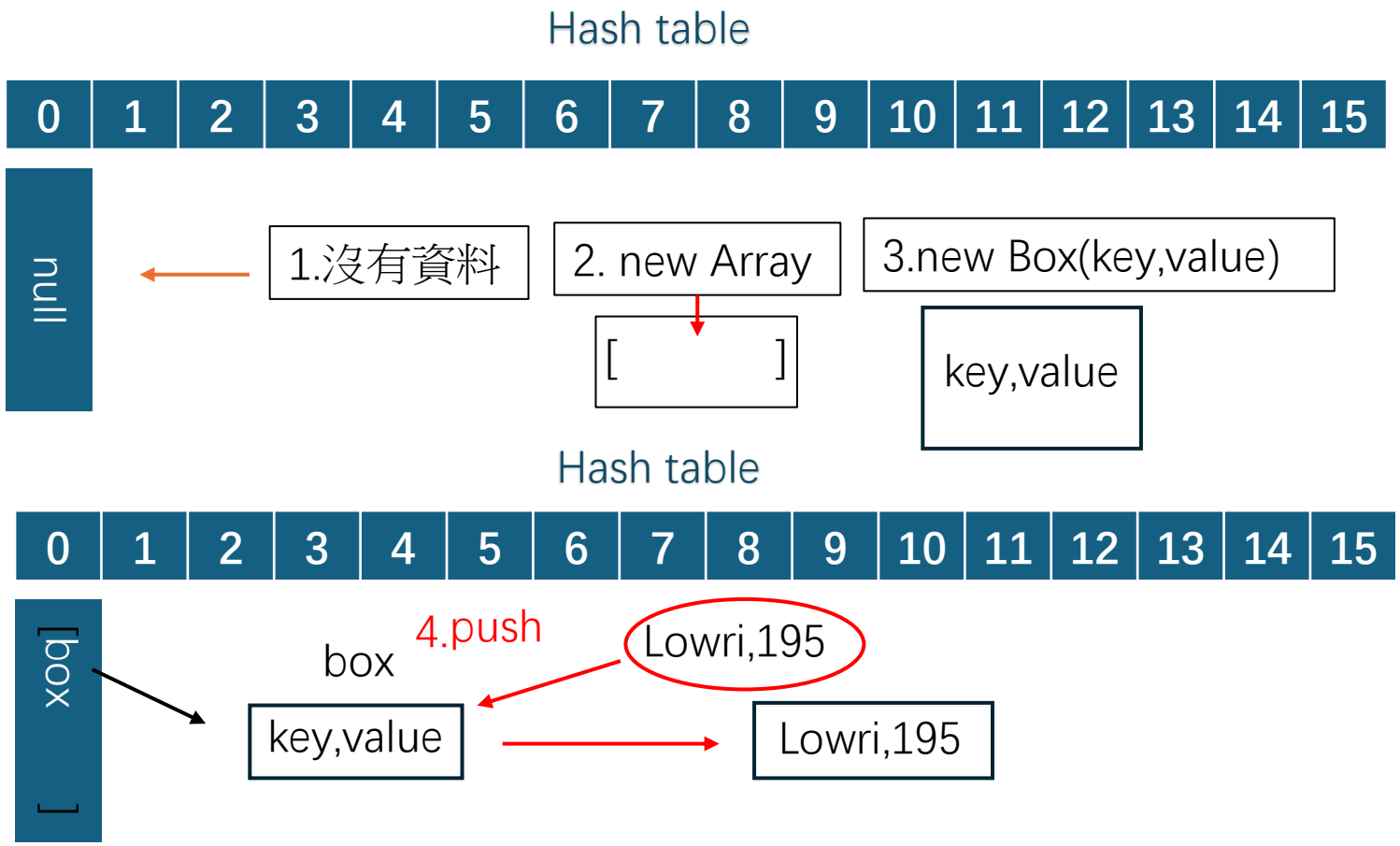
概念是透過雜湊函數計算出key所對應的一個slot，將該組key與value存入該slot之中，進而建立雜湊表格，如果不同的key找到相同對應的slot時，則在該slot內依序存進該slot中的陣列裡面。當要尋找資料時，key能快速找到其相對位置的slot，如果不同的key找到相同對應的slot時，則在該slot內的陣列中線性搜尋該相同的key，並取得其相對應的value，如此有加密與節省尋找時間的功能。



本程式使用的雜湊函數是以charCodeAt()，將key的字串先換成整數後除以slots的size取餘數來決定key與value放的slot位置，在本程式中的雜湊表size是16，所以就是餘16。
本程式用class 定義box 來存放key與value，定義HashTable 有16個slots預先填入null，並用length存入資料的數量。

```
22      add(key,value) {
23          const hashIndex = hash(key, this.size);
24          const slot = this.slots[hashIndex];
25          if (!slot) {
26              this.slots[hashIndex] = new Array();
27              let box = new Box(key,value);
28              this.slots[hashIndex].push(box);
29              this.length++;
30          } else {
31              let found=false;
32              for(let i=0;i<slot.length;i++) {
33                  let box = slot[i];
34                  if (box.key==key) {
35                      box.value=value;
36                      found=true;
37                      break;
38                  }
39              }
40              if (!found) {
41                  let box = new Box(key,value);
42                  this.slots[hashIndex].push(box);
43                  this.length++;
44              }
45          }
46      }
```

add(key,value)是將key與value存入slot的方法，會先用if確認該slot內是否已經有陣列可以存放box，如果沒有就先創建一個陣列，再創建1個box放入陣列中，然後將box用push填入box陣列中，



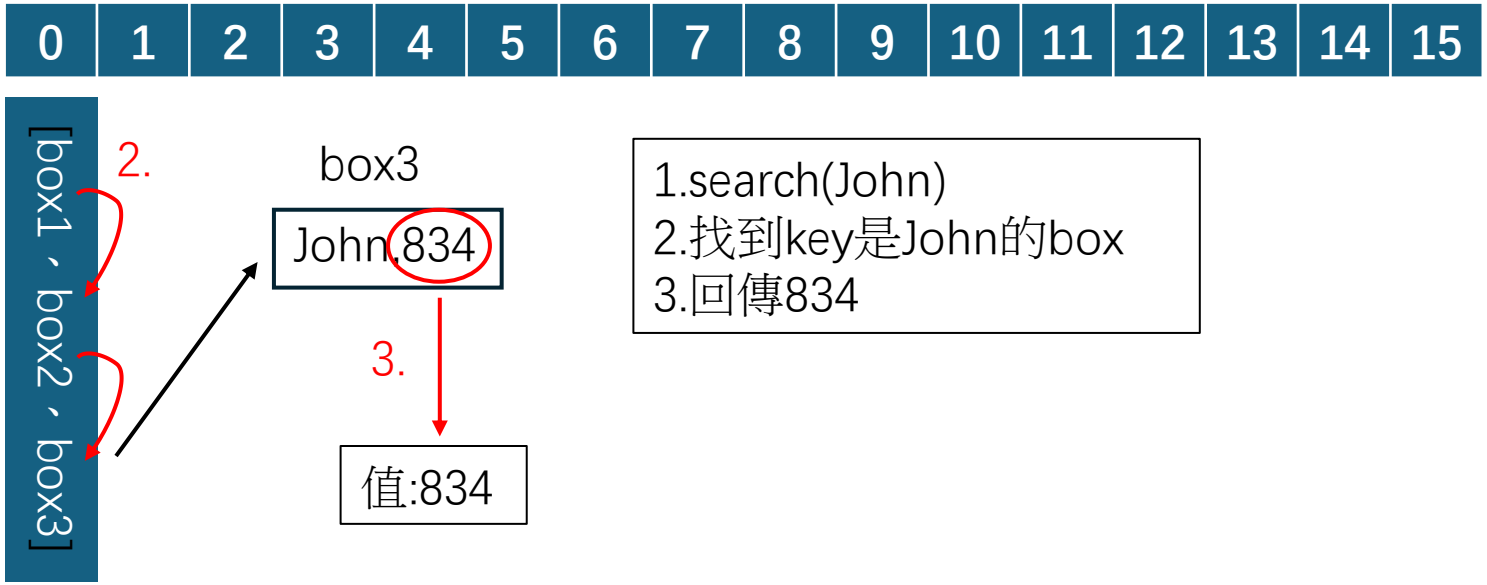
```
22      add(key,value) {
23          const hashIndex = hash(key, this.size);
24          const slot = this.slots[hashIndex];
25          if (!slot) {
26              this.slots[hashIndex] = new Array();
27              let box = new Box(key,value);
28              this.slots[hashIndex].push(box);
29              this.length++;
30          } else {
31              let found=false;
32              for(let i=0;i<slot.length;i++) {
33                  let box = slot[i];
34                  if (box.key==key) {
35                      box.value=value;
36                      found=true;
37                      break;
38                  }
39              }
40              if (!found) {
41                  let box = new Box(key,value);
42                  this.slots[hashIndex].push(box);
43                  this.length++;
44              }
45          }
46      }
```

如果slot中已經有box陣列的情況下，如果有相同key不同value的資料加入時，本程式會用新資料替換掉舊資料，用一個found變數當flag，預設為false，然後用for迴圈在陣列中線性尋找是否有相同的key的box。如果有找到相同key的box，則將新的value替換進該box中，將found設為true，然後離開迴圈。這樣就可以將舊value換成新value了。而如果沒有找到相同的key，則該key為新的key，則創建1個新的box放入box陣列中，然後將資料用push填入box陣列中。

唯有替換資料的部分沒有放入**this.length++**，因為資料總數不變。

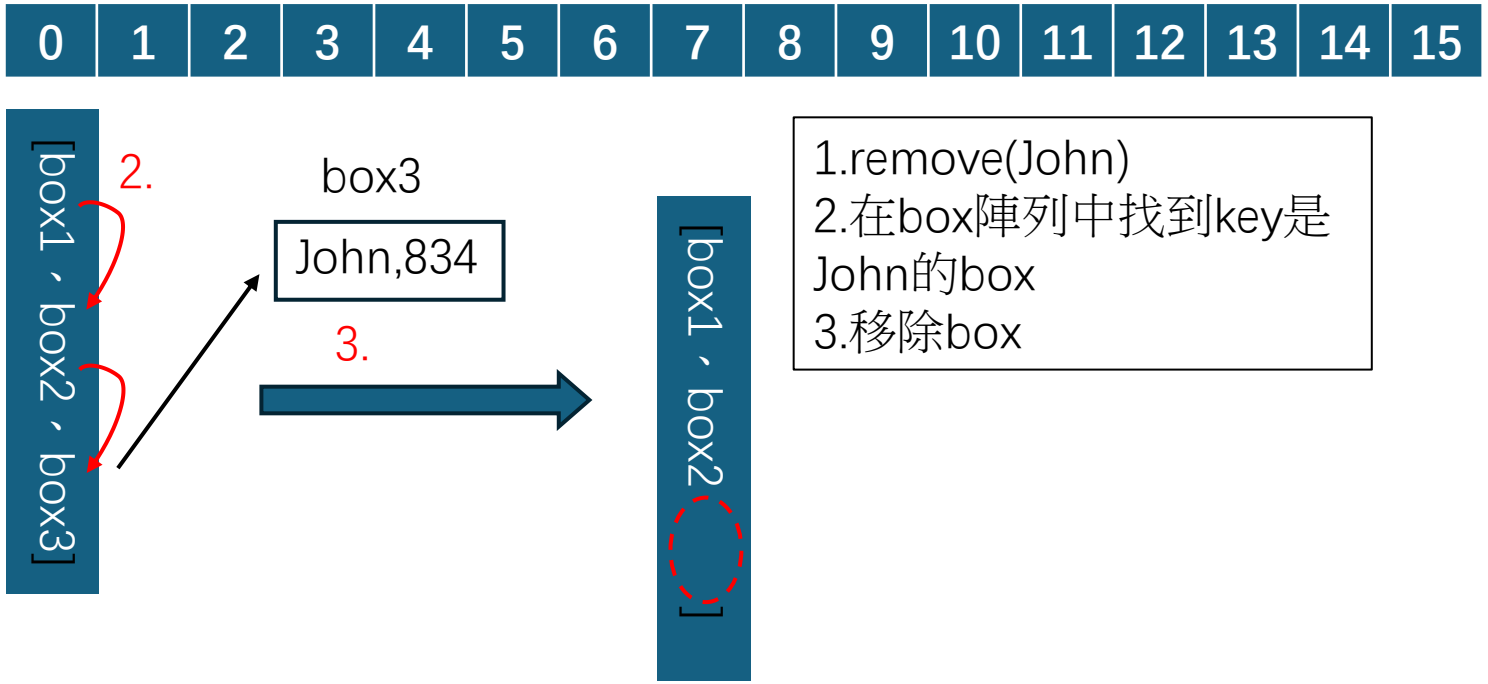
```
47      search(key) {
48          const hashIndex = hash(key, this.size);
49          const slot = this.slots[hashIndex];
50          for (let i=0;i<slot.length;i++) {
51              let box = slot[i];
52              if (box.key==key) {
53                  return box.value;
54              }
55          }
56          return "查無此資料!";
57      }
```

search(key)是用key找到已存入資料的方法，透過hash函數找到slot，再利用for迴圈在box陣列內線性搜尋是否有相同的key的box，若有相同，則回傳該box中的value，否則回傳"查無此資料!"。



```
58      remove(key) {
59          const hashIndex = hash(key, this.size);
60          const slot = this.slots[hashIndex];
61          for (let i=0;i<slot.length;i++) {
62              let box = slot[i];
63              if (box.key==key) {
64                  slot.splice(i,1);
65                  this.length--;
66              }
67          }
68          return "資料已清除!";
69      }
70  }
71
72  const ht = new HashTable();
73
74  ht.add("Louis", "767");
75  ht.add("Lowri", "195");
76  ht.add("Michelle", "162");
77  ht.add("Julie", "934");
78  ht.add("John", "329");
79  ht.add("Theresa", "331");
80  ht.add("John", "834");
81  ht.add("Eddie", "378");
82  ht.add("Robin", "77");
83  ht.add("Alfie", "532");
84  ht.add("Ava", "249");
85  ht.add("Owen", "208");
86  ht.add("Theodore", "539");
87  ht.add("Savannah", "54");
```

remove(key)是用來移除資料的方法，同樣透過透過hash函數找到slot，再利用for迴圈在box陣列內線性搜尋是否有相同的key的box。如果有，就使用splice將該位置的box移除。最後回報"資料已清除!"。



```
88    ht.add("Marc", "938");
89    ht.add("Sara", "420");
90    ht.add("Carmen", "599");
91    ht.add("Christine", "415");
92    ht.add("Mary", "671");
93    ht.add("Melissa", "171");
94    ht.add("Gethin", "483");
95    ht.add("Vanessa", "396");
96    ht.add("Eden", "638");
97    ht.add("Zoya", "72");
98    ht.add("Mae", "23");
99    ht.add("Edith", "609");
100   ht.add("Elizabeth", "660");
101   ht.add("Abdul", "619");
102   ht.add("Tabitha", "745");
103   ht.add("Jon", "957");
104   ht.add("Francis", "621");
105   ht.add("Millie", "767");
106
107   console.log(ht.search("John"));
108   console.log(ht.search("Ava"));
109   console.log(ht.remove("John"));
110   console.log(ht.search("John"));
```

這是實際程式表現出來的結果

完整程式列表

```
function hash(key, size) {
    let hashCode = 0;
    for (let index in key) {
      hashCode += key.charCodeAt(index);
    }
    return hashCode % size;
}

class Box {
    constructor(key,value) {
        this.key=key;
        this.value=value;
    }
}

class HashTable {
    constructor() {
      this.size = 16;
      this.slots = new Array(this.size).fill(null);
      this.length = 0;
    }
    add(key,value) {
        const hashIndex = hash(key, this.size);
        const slot = this.slots[hashIndex];
        if (!slot) {
            this.slots[hashIndex] = new Array();
            let box = new Box(key,value);
            this.slots[hashIndex].push(box);
            this.length++;
        } else {
            let found=false;
```

```
            for(let i=0;i<slot.length;i++) {
                let box = slot[i];
                if (box.key==key) {
                    box.value=value;
                    found=true;
                    break;
                }
            }
            if (!found) {
                let box = new Box(key,value);
                this.slots[hashIndex].push(box);
                this.length++;
            }
        }
    }
    search(key) {
        const hashIndex = hash(key, this.size);
        const slot = this.slots[hashIndex];
        for (let i=0;i<slot.length;i++) {
            let box = slot[i];
            if (box.key==key) {
                return box.value;
            }
        }
        return "查無此資料!";
    }
    remove(key){
        const hashIndex = hash(key, this.size);
        const slot = this.slots[hashIndex];
        for(let i=0;i<slot.length;i++){
            let box = slot[i];
            if(box.key==key){
                slot.splice(i,1);
                this.length--;
            }
```

```
            }
            return "資料已清除!";
        }
    }

    const ht = new HashTable();

    ht.add("Louis", "767");
    ht.add("Lowri", "195");
    ht.add("Michelle", "162");
    ht.add("Julie", "934");
    ht.add("John", "329");
    ht.add("Theresa", "331");
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    ht.add("Robin", "77");
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    ht.add("Zoya", "72");
    ht.add("Mae", "23");
    ht.add("Edith", "609");
    ht.add("Elizabeth", "660");
```

```
ht.add("Abdul", "619");
ht.add("Tabitha", "745");
ht.add("Jon", "957");
ht.add("Francis", "621");
ht.add("Millie", "767");

console.log(ht.search("John"));
console.log(ht.search("Ava"));
console.log(ht.remove("John"));
console.log(ht.search("John"));
```