Mr. Spocks Dilemma n選K的組合數 (第元一)

C(n,k) include Earth + don't include Earth.

C(n,k) = C(n-1,k-1) + C(n-1,k) 遞迴

終止條件

C(k,k) = 1 全部都選到了.

C(n,0) = 1 不用選任何東西

C(n,k) k>n 要選的比原本就還要多了.

Recursive solution.

C(n,k) = 1 if k=0 (特殊) 1 if k=n. 0 if k>n.

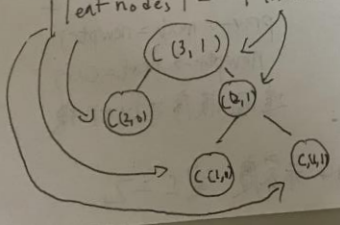
C(n-1,k-1) + C(n-1,k) if 0<k<n.

Property of Binary tree.

Leaf nodes: recursive calls to base cases. 葉節點

Internal nodes: recursive calls to non-base cases. 內部節點

|Leaf nodes| - |Internal node| = 1 數量差一



Number of Recursive Calls for C(n,k)

Leaf nodes = C(n,k) 的答案

Leaf nodes + Internal nodes = C(n,k) 的遞迴呼叫次數

Better Recursive Solution

$C(n,k) = \frac{n!}{(n-k)!\,k!} = \frac{n\,C(n-1)!}{k(n-k)!\,(k-1)!} = C(n-1,k-1)$

n變小 k變小 (比較好求).

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Pointer-Based Linked Lists (第元三) 鏈結串列.

A node in a linked list is usually a struct

```
Struct Node {
  int item
  Node *next ;
} ;
```

以指標完成 (指向) 幫助你取得下一個節點資料

if head is NULL the linked list is empty.

A node is dynamically allocated.

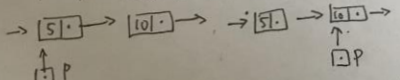
Node *p; // pointer to node (一張空白門牌)

P = new Node. // allocate node (一棟新房子)

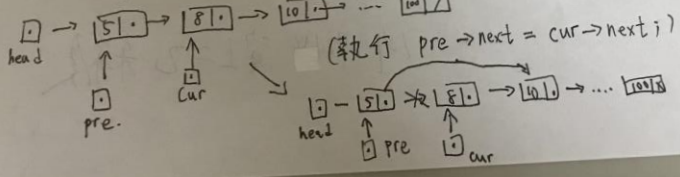
Reference a node member with the → operator.

p → item. (取得內容)

P = P → next (走訪下一個指標).

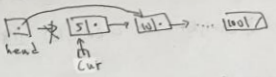


Deleting an interior node. (刪除節點)



Deleting the first node (刪第一個)

head = cur → next



Cur → next = NULL; delete cur; Cur = NULL;

(釋放節點)

不一定要做, 但是可以避免發生錯誤

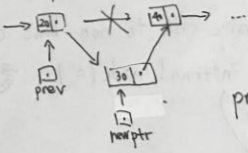
(cur → next = NULL; cur = NULL;) delete cur;

雖然語法合理, 但是已把cur改NULL

就不能delete (順序很重要).

To insert a node between two nodes. 新增節點

newptr → next = cur; prev → next = newptr;



prev → next = newptr;

newptr → next = cur;

這個順序可以切換.

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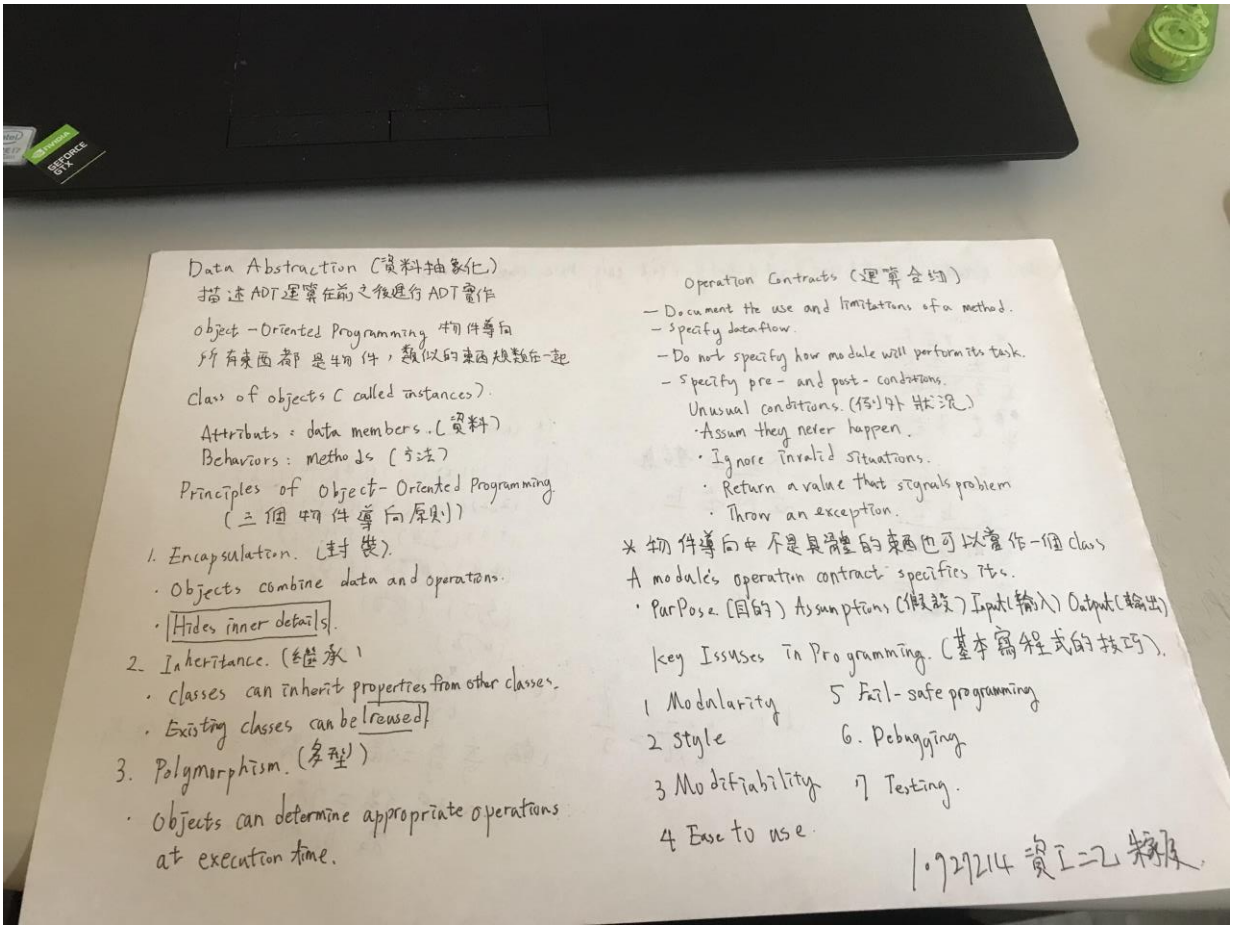

Data Abstraction (資料抽象化)
描述ADT運算在前之後進行ADT實作

object-Oriented Programming 物件導向
所有東西都是物件，類似的東西規類在一起

Class of objects C called instances).

Attributes: data members. (資料)
Behaviors: methods (方法)

Principles of Object-Oriented Programming
(三個物件導向原則)

1. Encapsulation. (封裝).
   - Objects combine data and operations.
   - Hides inner details.
2. Inheritance. (繼承)
   - classes can inherit properties from other classes.
   - Existing classes can be reused.
3. Polymorphism. (多型)
   - Objects can determine appropriate operations at execution time.

Operation Contracts (運算合約)

- Document the use and limitations of a method.
- Specify dataflow.
- Do not specify how module will perform its task.
- Specify pre- and post-conditions.

Unusual conditions. (例外狀況)
- Assum they never happen.
- Ignore Invalid situations.
- Return a value that signals problem
- Throw an exception.

* 物件導向也不是真理的東西也可以當作一個 class

A module's operation contract specifies its.
- ParPose. (目的) Assumptions (假設) Input (輸入) Output (輸出)

key Issuses in Programming. (基本寫程式的技巧).

1 Modularity
2 Style
3 Modifiability
4 Easy to use
5 Fail-safe programming
6. Debugging
7 Testing.

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