

河內塔

- 什麼是河內塔？

河內塔是法國數學家愛德華·盧卡斯根據一個傳說形成的數學問題：

「有三根柱子，原先有n個圓盤套在同一根柱子，圓盤依大小由下而上，越上層則越小。

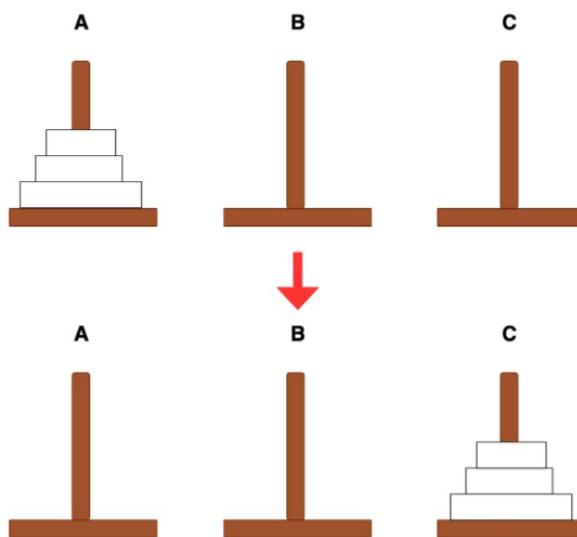
如果完成移動n個圓盤套在其他的同一根柱子，需要移動的次數是多少？」此問題遵循下列規則：

1. 每次只能移動一個圓盤；
2. 大盤不能疊在小盤上面。

問：如何移？最少要移動多少次？

- 和recursion(遞迴)有什麼關係？

由於河內塔遵循著簡單的數學規則，可以將其劃整為 $a=2^n-1$ 。故可以利用程式寫出遞迴計算式利用計算機計算。



- 怎麼用recursion解決此問題？

程式碼：

```

1 #include <stdio.h>
2 #include <stdlib.h>
3 #include <time.h>
4 void hanoi(int n, char A, char B, char C) {
5     if(n == 1) {
6         printf("Move sheet from %c to %c\n", A, C);
7     }
8     else {
9         hanoi(n-1, A, C, B);
10        hanoi(1, A, B, C);
11        hanoi(n-1, B, A, C);
12    }
13 }
14

```

```

15 int main() {
16     clock_t start, end;
17     start = clock();
18     int n;
19     printf("請輸入盤數：");
20     scanf("%d", &n);
21     hanoi(n, 'A', 'B', 'C');
22     end = clock();
23     double diff = end - start; // ms
24     printf(" %f ms", diff);
25     printf(" %f sec", diff / CLOCKS_PER_SEC );
26     return 0;
27 }
28

```

運算結果：

```
Move sheet from A to C
Move sheet from B to C
Move sheet from B to A
Move sheet from C to A
Move sheet from C to B
Move sheet from A to B
Move sheet from C to A
Move sheet from B to C
Move sheet from B to A
Move sheet from C to A
Move sheet from B to C
Move sheet from A to B
Move sheet from A to C
Move sheet from B to C
Move sheet from B to A
Move sheet from C to B
Move sheet from A to B
Move sheet from A to C
Move sheet from B to C
Move sheet from B to A
Move sheet from C to A
Move sheet from B to C
Move sheet from A to B
Move sheet from A to C
Move sheet from B to C
Move sheet from B to A
Move sheet from C to B
Move sheet from A to B
Move sheet from A to C
Move sheet from B to C
Move sheet from B to A
Move sheet from C to B
Move sheet from A to C
Move sheet from B to C
170465.000000 ms 0.170465 sec
```

```
...Program finished with exit code 0
Press ENTER to exit console.
```

運行CPU型號:

Intel(R) Core(TM) i7-4720HQ CPU @ 2.60GHz

