Program Test #3 (1)

- In-class Test: Dec. xx (Thu.) 13:10-16:00
- TA: 吳柏廷 (d0948227@mail.fcu.edu.tw)
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- Software: Dev-C++
- Submission:
  - Filename format:
    學號_PT#.c
    例如: M06455505_PT3.c
  - 16:00 前，現場完成 demo，並且簽名

Program Test #3 (2)

- Grading:
  - Correctness 50%
  - Program structure 20%
  - Comments 10%
  - Header block 5%
  - Variable dictionary 10%
  - Procedures and functions 5%
- Special notice:
  - 請勿抄襲別人程式(助教會當場進行測問、判定)，或是遲交作業，否則一律 0分計算
  - 請一律使用 C 語言來撰寫程式，且必須保證你的程式能夠再 Dev-C++ 軟體上成功編譯與執行，使用其他程式語言一律不予計分
  - 請依照題目給的輸入格式，否則不計分
  - 本次上機測驗有一個題目，佔比為100%

Program Test #3 (3)

- Problem 1 (100%):

  Definition:

  A number of K balls are dropped one by one from the root of a fully binary tree structure FBT. Each time the ball being dropped first visits a non-terminal node. It then keeps moving down, either follows the path of the left subtree, or follows the path of the right subtree, until it stops at one of the leaf nodes of FBT. To determine a ball's moving direction a flag is set up in every non-terminal node with two values, either **false** or **true**. Initially, all of the flags are **false**. When visiting a non-terminal node if the flag's current value at this node is **false**, then the ball will first switch this flag's value, i.e., from the **false** to the **true**, and then follow the left subtree of this node to keep moving down. Otherwise, it will also switch this flag's value, i.e., from the **true** to the **false**, but will follow the right subtree of this node to keep moving down. Furthermore, all nodes of FBT are sequentially numbered, starting at 1 with nodes on depth 1, and then those on depth 2, and so on. Nodes on any depth are numbered from left to right.

Program Test #3 (4)

- Problem 1 (100%):

  Definition:

  For example, Fig. 1 represents a fully binary tree of maximum depth 4 with the node numbers 1, 2, 3, ..., 15. Since all of the flags are initially set to be false, the first ball being dropped will switch flag's values at node 1, node 2, and node 4 before it finally stops at position 8. The second ball being dropped will switch flag's values at node 1, node 3, and node 6, and stop at position 12. Obviously, the third ball being dropped will switch flag's values at node 1, node 2, and node 5 before it stops at position 10.

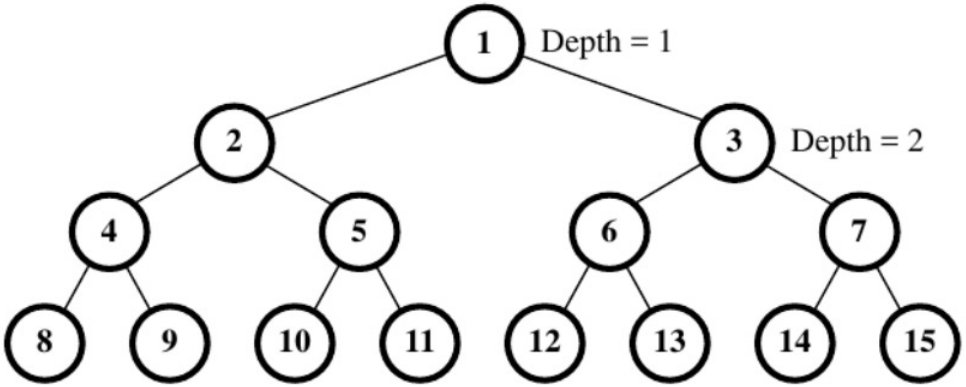

Fig. 1: An example of FBT with the maximum depth 4 and sequential node numbers.

Program Test #3 (5)

- Problem 1 (100%):

  Definition:

  Now consider a number of test cases where two values will be given for each test. The first value is D, the maximum depth of FBT, and the second one is I, the I-th ball being dropped. You may assume the value of I will not exceed the total number of leaf nodes for the given FBT.

  Please write a program to determine the stop position P for each test case.

  For each test cases the range of two parameters D and I is as below:

  $$2 \leq D \leq 20, \text{ and } 1 \leq I \leq 524288.$$

Program Test #3 (6)

- Problem 1 (100%):

Basic requirements:

Input: Contains l + 2 lines.

Line 1 l the number of test cases
Line 2 D1 I1 test case #1, two decimal numbers that are separated by one blank
...
Line k + 1 Dk Ik test case #k
Line l + 1 Dl Il test case #l

Output: Contains l lines.

Line 1 the stop position P for the test case #1
...
Line k the stop position P for the test case #k
...
Line l the stop position P for the test case #l

Example:

Input:

```
%> 5
%> 4 2
%> 3 4
%> 10 1
%> 2 2
%> 8 128
```

Output:

```
%> 12
%> 7
%> 512
%> 3
%> 255
```

這邊是中文翻譯

- K 個球從完全二元樹結構 FBT 的根部一一落下。 每次落下的球首先訪問非終端節點。 然後繼續向下移動，要麼沿著左子樹的路徑，要麼沿著右子樹的路徑，直到停在FBT的葉子節點之一。 為了確定球的移動方向，在每個非終端節點中設定一個帶有兩個值（假或真）的標誌。最初，所有標誌都是假的。 當存取非終端節點時，如果節點目前flag的值為false，那麼小球會先切換該flag的值，也就是從false變為true，然後沿著該節點的左子樹繼續向下移動。 否則，它也會切換該標誌的值，即從 true 變為 false，但會沿著該節點的右子樹繼續向下移動。此外，FBT 的所有節點都按順序編號，從深度 1 上的節點從 1 開始，然後是深度 2 上的節點，依此類推。 任何深度上的節點都從左到右編號。
- 例如，圖 1 表示最大深度為 4 的完全二元樹，節點編號為 1、2、3、...、15。由於所有標誌最初都設定為 false，因此第一個掉落的球將切換節點1、節點2 和節點4 處的flag 值會發生變化，最後停在位置8。第二個球落下將改變節點1、節點3 和節點6 處的flag 值，並停在位置12。顯然，第三個當球落下時，節點1、節點3 和節點6 的flag 值會改變。落下的球將在節點 1、節點 2 和節點 5 處切換標誌值，然後在位置 10 處停止。

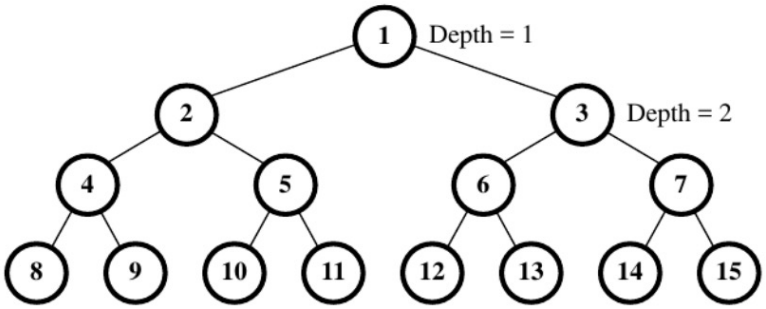

Fig. 1: An example of FBT with the maximum depth 4 and sequential node numbers.

以英文題目為主

- 現在考慮一些測試案例，其中每個測試都會給出兩個值。 第一個值是 D，即 FBT 的最大深度，第二個值是 I，即第 I 個球被掉落。 您可以假設 I 的值不會超過給定 FBT 的葉節點總數。
- 請寫一個程式來確定每個測試案例的停止位置 P。
- 對於每個測試案例，兩個參數 D 和 I 的範圍如下：
  - $2 \le D \le 20$, and $1 \le I \le 524288$.

Example:

Input:	Output:
%> 5	%> 12
%> 4 2	%> 7
%> 3 4	%> 512
%> 10 1	%> 3
%> 2 2	%> 255
%> 8 128	

以英文題目為主