109 Data Structure the 2nd Homework

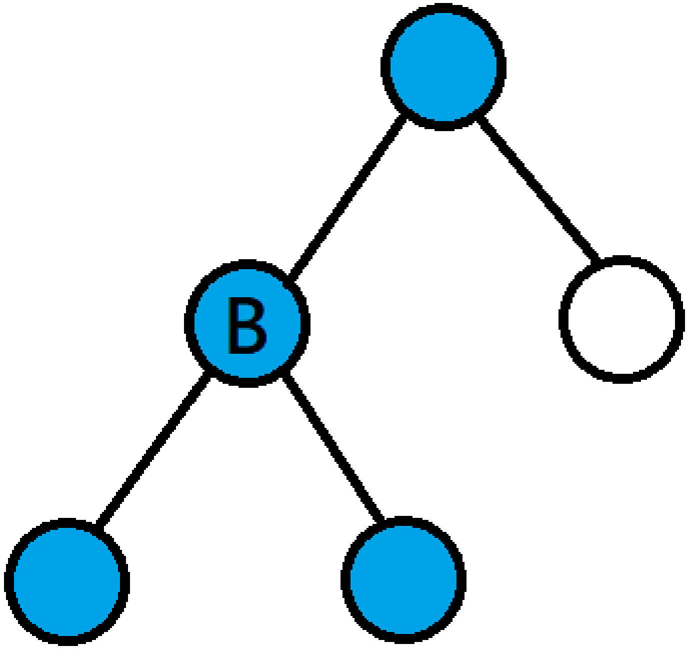
Operation Overlord (60%)

- 1) Set the Allies’ bases optimally (20%)
- You think you may treat the Omaha Beach, which was the code name for one of the five sectors of the invasion, as a root.
- The Allies may expand bases with a tree-like structure.

- To simplify this problem, you may treat the tree-like structure as a binary tree.
- Each base may guard its parent, itself, and its two child nodes.

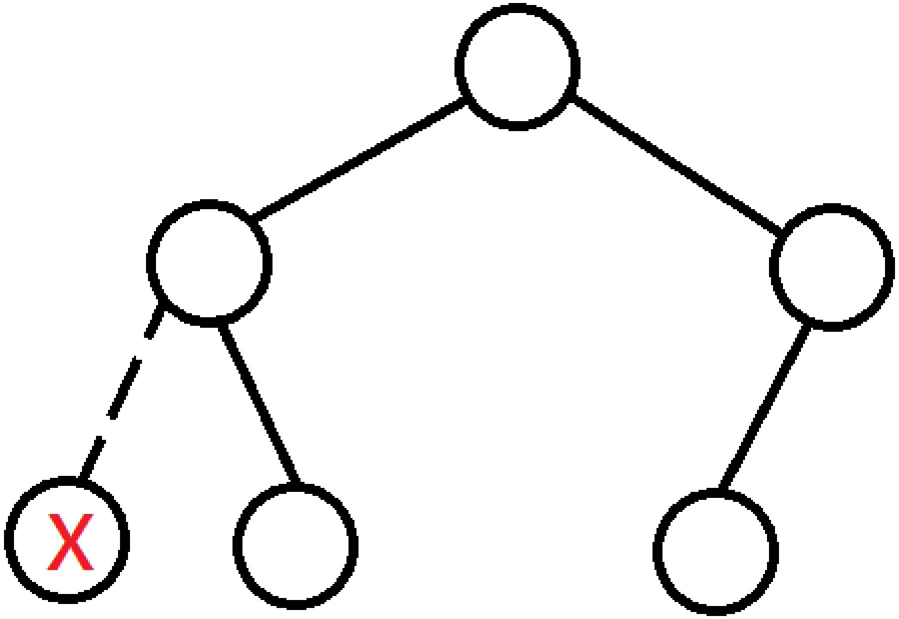
Operation Overlord (60%)

- For example, you build a base in the node B, the blue nodes will be secured.
- You need to build the least base while making sure every lodgements are secured.



Operation Overlord (60%)

- input: [0,0,0,null,0,0] (The X node doesn’t exist.)
- output: 2
- You may assume you can construct a valid tree with the input.



Operation Overlord (60%)

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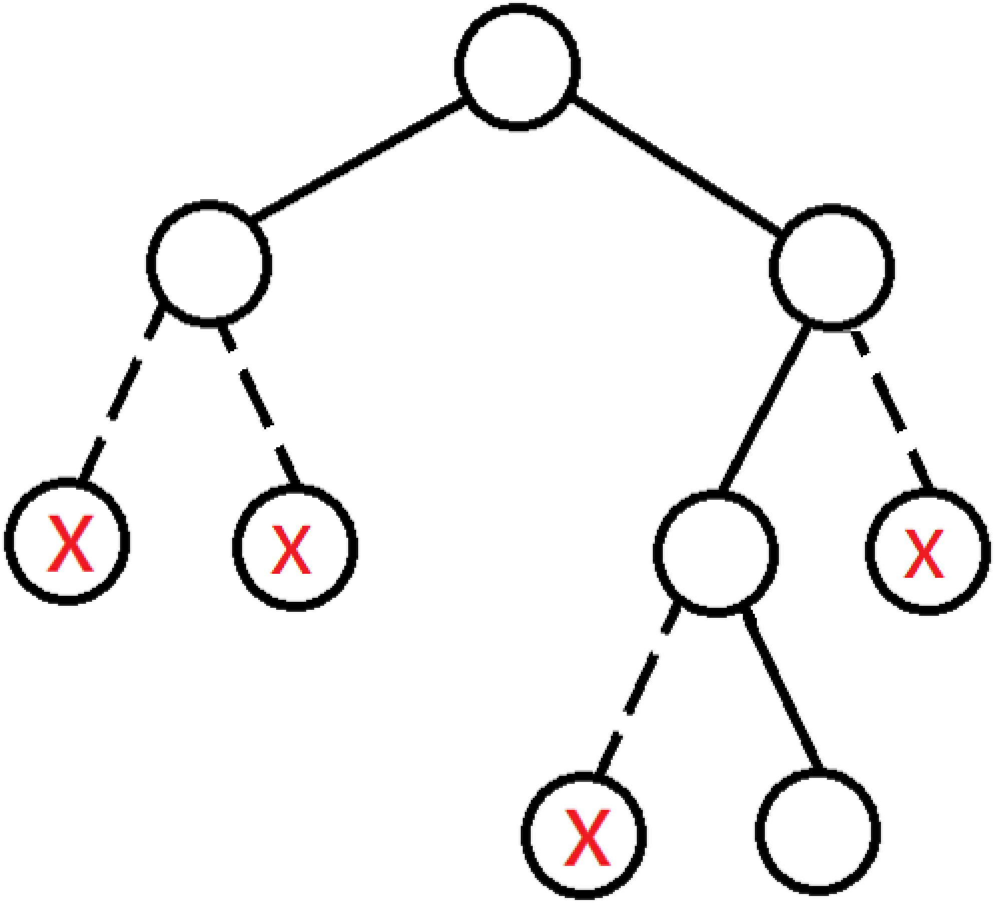


Operation Overlord (60%)

- struct TreeNode {
- int data;
- struct **TreeNode** *left;
- struct **TreeNode** *right;
- };

- You SHOULDN’T modify the fields in TreeNode.
- However, you CAN modify the values if you want.
- You SHOULDN’T directly read the input as a string or an array.
- Please build a tree stored the values and operate with that tree.
- Traversing the tree and reconstructing it with an array is NOT allowed, either.

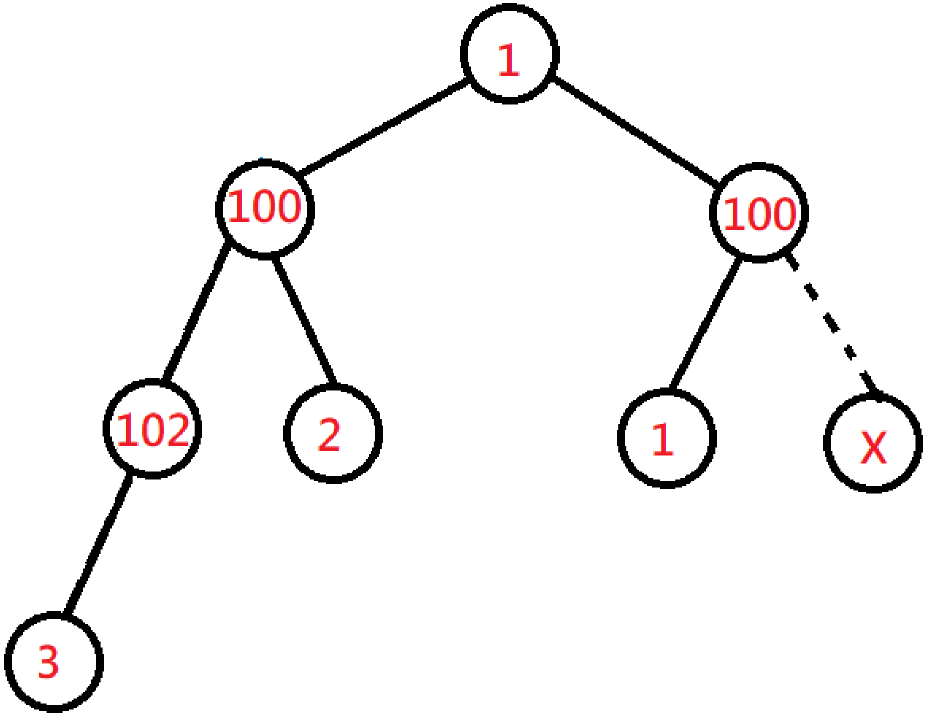
Operation Overlord (60%)

- 2) Set the Allies’ bases optimally - II (20%)
- You first make a rough plan. However, the battlefield cannot be treated as such a simple scene.
- You next consider the enemies. Some places may not be conquered so easily.
- However, you may build up your base next to it and nibble them slowly.

- What you need to do is to calculate how to pare down our expenses to a bare minimum.

Operation Overlord (60%)

- The data field stored in a TreeNode indicates the cost for building a base there.
- input: [1,100,100,102,2,1,null,3] (The X node doesn’t exist.)
- output: 7 (1+2+1+3)



Operation Overlord (60%)

- For both of the problems:

- The number of nodes in the tree is N.
- 0 <= N <= 15000
- Time limit: 1 second per data.
- 1st problem
  - TreeNode.data = 0
- 2nd problem
  - 0 <= TreeNode.data <= 1000

Operation Overlord (60%)

- 3) Spot the liars (20%)
- Your army caught some prisoners of war. Most of them are still loyal to Germany. However, some of them WERE loyal to Germany.
- Now, they point each other and say he/she is a liar. You need to figure out who is trying to tell the truth.

Operation Overlord (60%)

- For each input:
- Line 1: An integer N for the number of prisoners. ($1 < N < 21$)
- Line 2: An integer M for the number of liars. ($0 < M < N$)
- Next N lines: A string allegation indicates what the prisoner said.

- An allegation is like: NO>NO>NO...=[T/L]
- The number of “>” is less than 600.
- You can translate the allegation by:
    - NO told that NO told me that NO...NO is telling the truth/lying.

- The liars always lie, the others always tell the truth.
- output: Who is/are the liar(s)?

Operation Overlord (60%)

- For example:
- 3 (N)
- 1 (M)
- 0>1=T
- 1>2=L
- 2>0=L

- output: 2
- You may assume there's only ONE answer in each case.

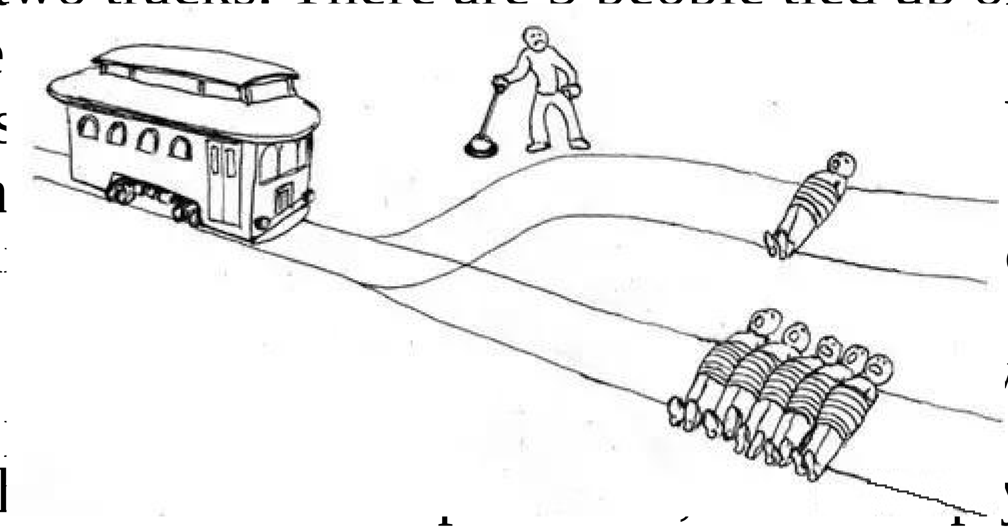
Operation Overlord (60%)

- For example:
- 3
- 2
- 0>1>2>1>0>2=L
- 1>2>0=L
- 2>0>1>2=L

- output: 0 1

Trolley Problem (50%)

- Trolley problem is a classical thought experiment in psychology. The basic version goes thus:
- There are two tracks. There are 5 people tied up on one of both while
- A trolley is You have two option
  - Do noth on the main track.
  - Pull the here it will kill one
- Which is th y: What is the right thing to do?



Trolley Problem (50%)

- You got caught by The Jigsaw Killer. He wants to play a game. You have to make a choice.
- Luckily, it is not such a hard problem to judge. There is always one track which is able to pass. Thus nobody will die.
- You only need to choose the right one as soon as possible.

Trolley Problem (50%)

- 1) Build a doubly and circular linked list, which indicates the platforms of a trolley station. (10%)

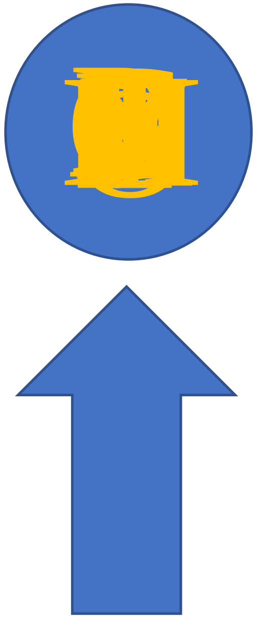
可以使用陣列來存取platform裡面的內容

  - There are 20 platforms.
  - You switch the platform you control with your joystick.
  - The last platform is connected to the first platform, creating a loop.
  - The target station of the platforms are initialized as “ “.

- Commands:
  - >: Switch to the platform on the right.
  - <: Switch to the platform on the left.
  - +: Change the target station of the platform with “plus 1”.
  - -: Change the target station of the platform with “minus 1”.
    - The target station of the platforms can be: {(space), A, B, …, Z}.
    - The station after Z is space. The station after space is A.
    - Please treat “ “ as a valid input.
  - .: Trolley departs from the platform to the target station under control.

Trolley Problem (50%)

- For example:
- input: + . + + . . + + + + + + . + + + + + + .
- output: A C C I O

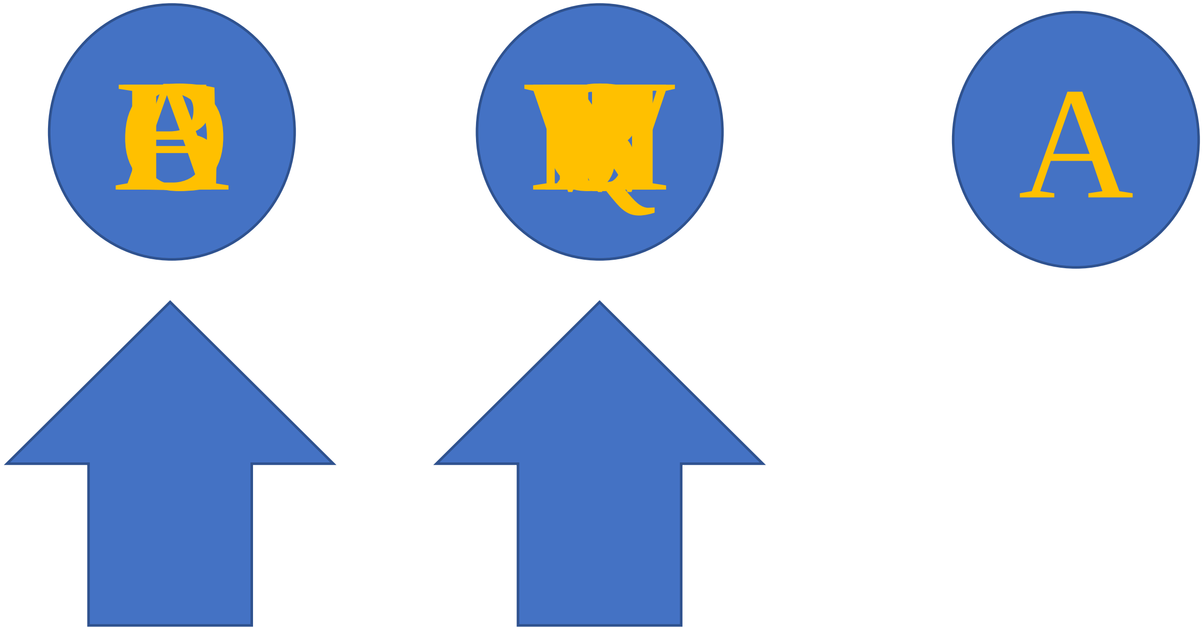


Trolley Problem (50%)

- 2) Try to optimize the process. (40%)
- Time limit: 3 seconds per input.
- After all the strings' inputted are handled, I'll sum up all your output strings' length and compare with my algorithm.
- You will get different grades if the sum of your lengths are:
    - 0% : 400% longer than my algorithm.
    - 10% : 100% longer than my algorithm.
    - 20% : 10% longer than my algorithm.
    - 30% : [-5% .. 10%] length of my algorithm.
    - 40% : over 5% shorter than my algorithm.

Trolley Problem (50%)

- EXPELLIARMUS
- output: +++++.>---.--------.<.>----..---
  .>+.<+++++++++.-----.++++++++.--.
- (The animation only demonstrates the part of “EXPELLIA”)



Reminders

- For all of the question, please read test.txt as input.
- 對於所有問題，請都讀test.txt作為input

- If you can, please let me know how to change your I/O file name so that I can modify the path from test.txt to test1.txt, test2.txt, etc.
- 假如可以的話，讓我清楚知道從哪裡更改你I/O檔案的名稱，方便我可以從讀test.txt改成讀test1.txt, test2.txt，會改得比較快。
- 如果我看不懂，那我不會改你的code，一律讀test.txt。

Reminders

- Only accept C
- Deadline : 2020/11/16 23:59, please be on time.
- File name : [student ID]_[question No.(1or2)]-[sub question No.(1,2,3)].[file name extension]
- e.g. 7109056193_1-1.c
- If there are more than 1 file for 1 question, please give a readme.txt for me and let me know the meaning of each file.
- No need to give me the output, I’ll execute your program.

- Zip all your files and hand in on the i-learning, the file name is [student ID]_homework2.
- Plagiarism is prohibited.
- Dev-C++ 5.11 is used for checking this homework.