Should operator << be a member or a non-member method?

Consider what we want:
- Consistency in use of cout:
  
  ```
  UCSDStudent stu ("Tracker", 123);
  cout << stu;
  
  Is consistent like:
  cout << "Hello World\n";
  ```

“cout << stu;” translates to either:

```
_________________    // member method of ostream
``` 

or

```
_________________    // non-member call
``` 

The operator << method as a member of UCSDStudent:

```
_______________________________
``` 

translates to:

```
_______________________________
``` 

How will a non-member method gain access to private data fields?

We trust our ____________!

```
"________":
  - keyword is C++ that announces __________.
  - announces who can access _____________.
  - too many _______ accessing _____ is _____ a good idea.
  - ________ two way relationship.
  - extend membership to _________________.
    o ________________________ are examples.
```
Remove from a Binary Tree.

Removal of a leaf TNode:
How:
- Assign the pointer in the parent TNode to null.
- Call SetHeightAndBalance as you go back up the Tree.

Removal of a TNode with one child:
How:
- Assign the pointer in the parent TNode to the child of the TNode that is going away.
- Call SetHeightAndBalance as you go back up the Tree.

Removal of a TNode with two children:
Consider: You must maintain the binary search properties
- ___________________
- ___________________
- ___________________.
How:
- Call ReplaceAndRemoveMax
ReplaceAndRemoveMax:
- Replace: Replace the data in the target TNode with the data from the ________________ TNode.
- Max: __________ is found as the ______ TNode in the _____ sub-Tree:

Algorithm: Go left, then all the way right to find the predecessor TNode.
- __________:
  o Must have a _____ right child (by definition)
  o Could have a _____ left child.

Philosophy of Remove:
- ______ TNode is in charge.
- The ______ TNode makes the decision on which TNode is its replacement in the parent TNode.
- Achieved through the non-const “__________” reference parameter.

The PointerInParent non-const reference parameter:
What: Another name for the pointer in the parent TNode that was used to get to the target TNode.
How: The target TNode resets the PointerInParent as part of the removal algorithm.
Establishing PointerInParent:
- Throughout your code, calls like:
  o left->Insert (... , left);
  o right->Remove (... , right);
  o left->ReplaceAndRemoveMax (... , left);
  o root->WhateverFunction (.... , root);
  o YOU MUST MATCH ON YOUR OWN!
Threshold on balance:
- We will impose a threshold on the balance of each TNode in the Tree:
  o balance must not exceed +/- 2
- Why: efficiency
  o The higher the abs(balance), the lesser the efficiency.
- Implementation:
  o Remove out-of-balance TNode.
  o Reinsert the item into the Tree.
    ▪ Specifically, reinsert into another TNode that is in the Tree.
  o Implemented as a check within the SetHeightAndBalance method.

SetHeightAndBalance:
Consider: Calling Remove from SetHeightAndBalance:
- After you return from call to Remove:
  o The current object (*this) ____________!
    ▪ Can’t: ______________
    ▪ ______________
    ▪ Can: ______________
  o Where to reinsert data that was removed:
    ▪ Use ______________:
      • Before Removal of current TNode, ____________ points to the ______________.
      • After Removal of current TNode, ____________ points to the ______________.
ReplaceAndRemoveMax:
How do you replace the data in the target TNode with the data from the immediate predecessor?
Answer: _______________!!!
- ____________________________________________________________________________
  __________.
- Once you find the immediate predecessor, the data in the ______________ can be reassigned.
  o The __________ was ______________ as you’ve moved down the Tree in your RARM calls.

Remove: elementTNode parameter:
- What: The Reference TNode that is a container that will hold ______________.
- What is special about it?
  o Origin:________________________.
  o Location in memory:__________.
  o Anything else:________________.
- How: Passed ____________________.
- Initial contents: ________________.
  o name ________, number ________.
- Final contents: ___________ UCSDStudent
  o name ________, number ________.
  o assigned by ____________________.
- Remember: send back _____ from elementTNode before returning from Tree’s Remove.
- Could we have used a Whatever & instead?
  o ______________________________._

Use of a reference parameter without a const prefix means that the method will change the parameter object!