Week 7

This Week

- Notepad++
- Mercurial
- Valgrind
- Bitwise Operators
- Data Structures (Stacks, Queues, Hash Tables, Binary Search Trees, Tries)

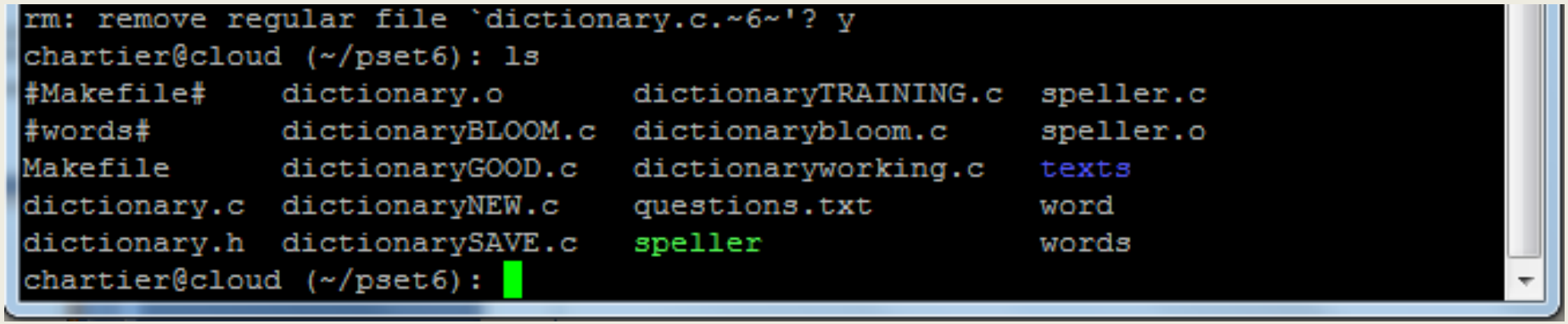
Notepad++

- Tried emacs but still hate the terminal? ☹
- Work in a GUI environment connected directly to the Cloud!
- This is better than WinSCP and a text editor. You don’t want to do that.

Mercurial

- RCS – Revision Control System

- Better than doing this:



Valgrind

- Pronunciation: val-grinned
- For best results:
  - valgrind –v –leak-check=full <program_name>
- Gives a report on status of memory allocated.

Bitwise Operators

& - AND

1100

&1010

1000

| - OR

0011

|1010

1011

^ - XOR

1010

^1100

0110

~ - NOT

~(1010) = 0101

Bitwise Encryption

One-time pad:

My string: 10001110

Encryption Key: 10011001

XOR Encrypted: 00010111

XOR Decrypted: 10001110

Bitwise Swap Without Temp Variable

```
int swap(int* x, int* y)
{
    *x ^= *y;
    *y ^= *x;
    *x ^= *y;
}
```

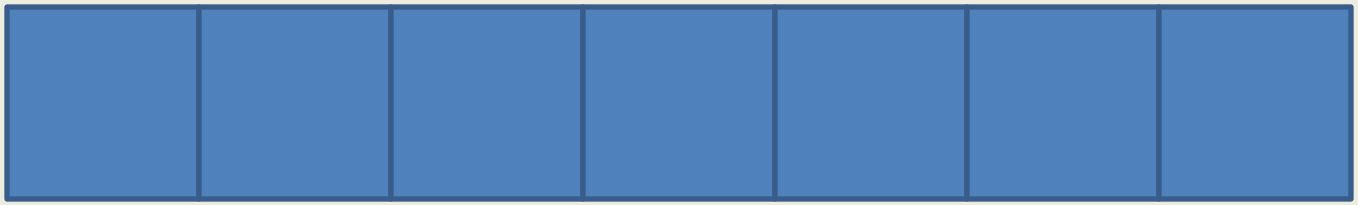
X - 1001	Y - 1100
0101	1100
0101	1001
1100	1001

Data Structures

- Stacks
- Queues
- Hash Tables
- Binary Search Tree
- Tries

Stacks

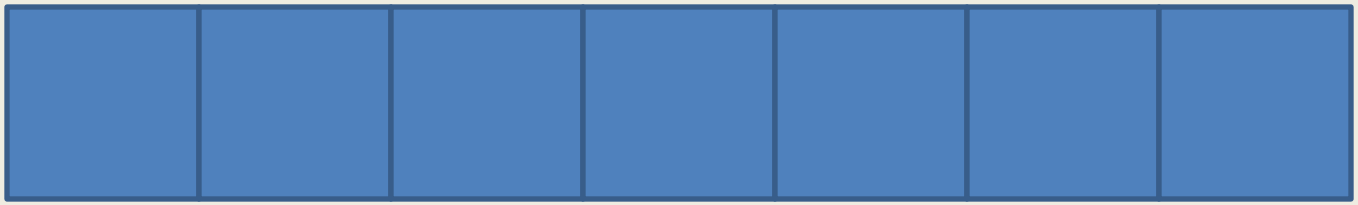
- First in, last out data structure.
- Can ‘pop’ or ‘push’ things to the top of the stack.



Top

Queues

- First in, first out data structure.
- “Insert” and “Remove” operations.



Hash Tables

- Consists of an array and a hash function.
- Hash function maps input to an index in the associated array.
- Allows us to check whether something is contained in a data structure without checking through the entire thing.

Hash Tables

Good Hash Functions are:

- Deterministic
- Well-distributed

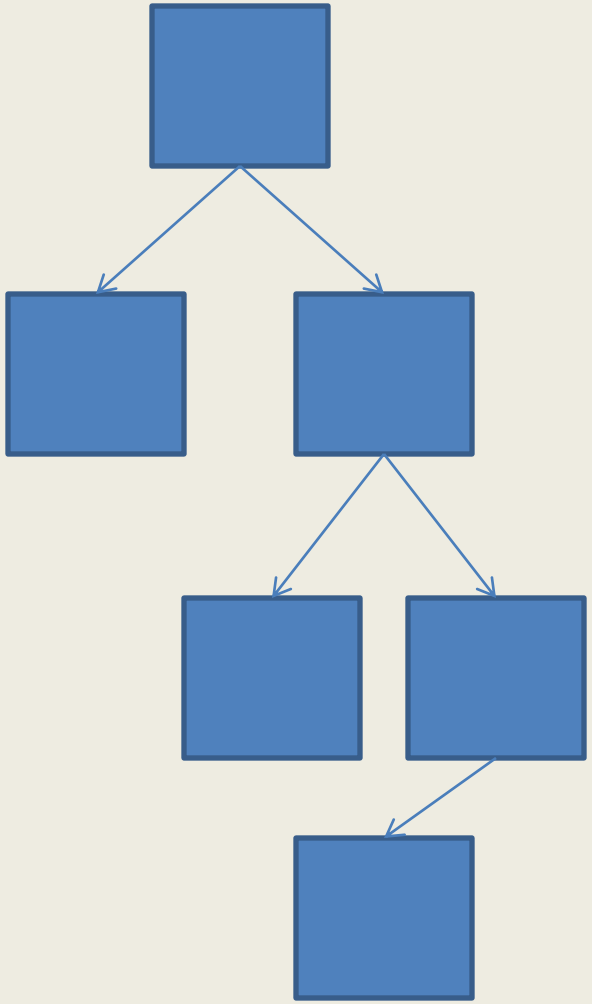
```
int
xkcd_hash(char* word)
{
    return 4;
}
```

THIS
IS BAD

Binary Search Tree

- Trees consist of ‘branches’.

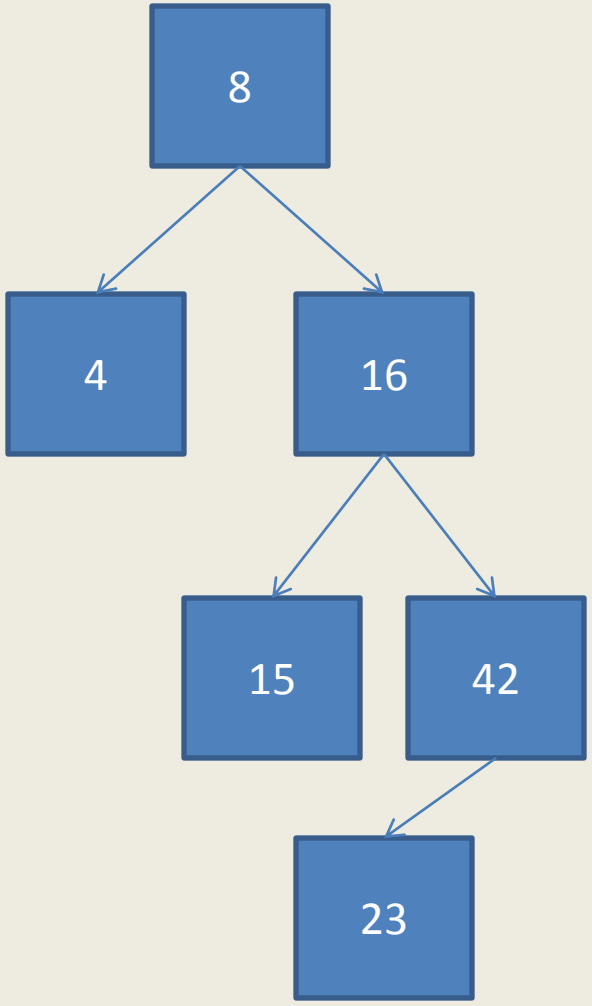
```
struct branch
{
    struct branch* left;
    int val;
    struct branc* right;
}
```



Binary Search Tree

BST is such that:

1) Left subtree of each node contains only lesser nodes.
2) Right subtree of each node contains only greater nodes.
3) Left and right subtrees of each node are also binary search trees.

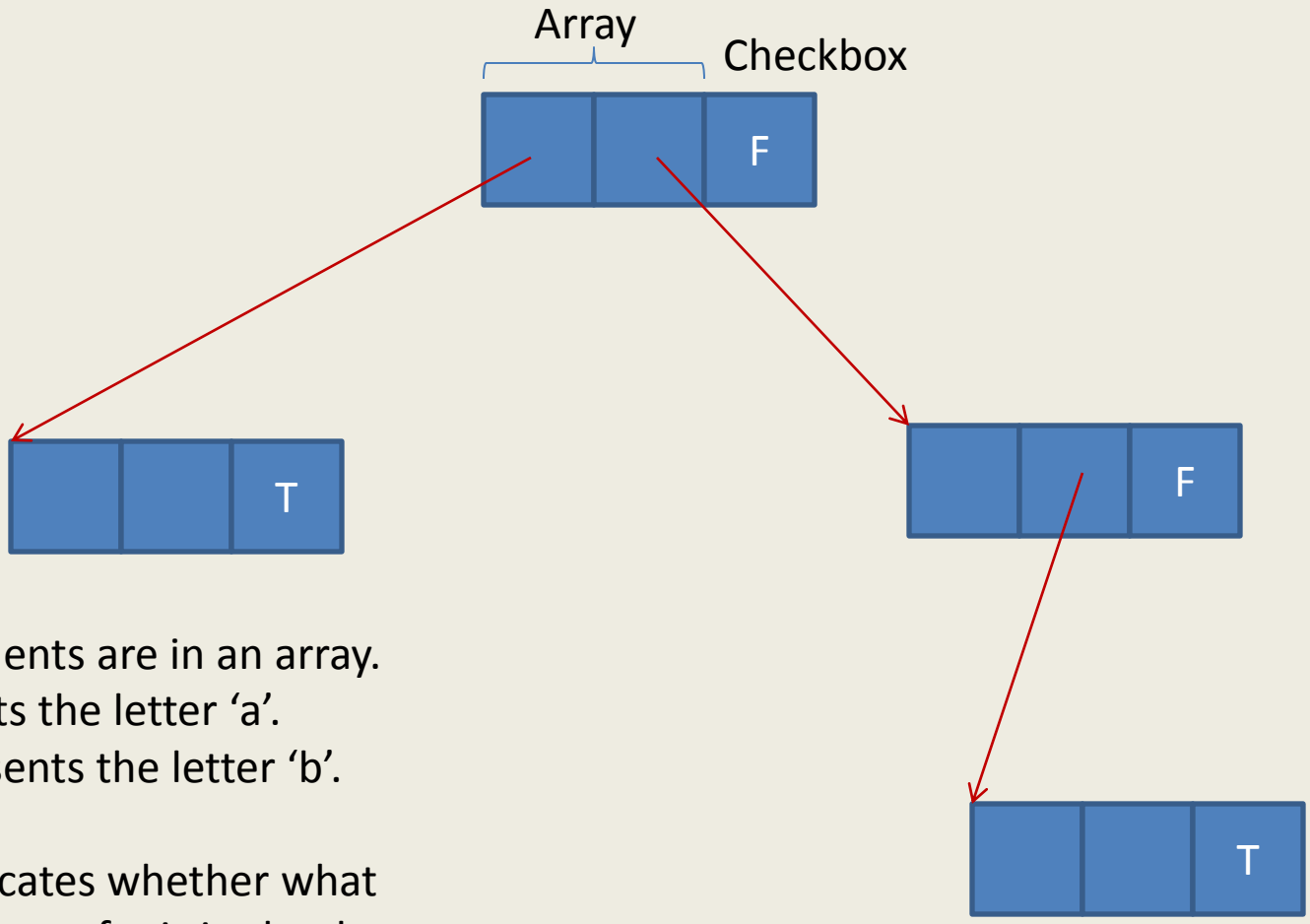


Tries

- Tree of Arrays
- Fast Lookup, High Memory Use

```
struct trie_node
{
    struct trie_node* array[N];
    bool checkbox;
}
```

Tries



First two elements are in an array.
First represents the letter ‘a’.
Second represents the letter ‘b’.

Checkbox indicates whether what we’ve looked at so far is in the data structure.

“a”, “bb” are in this structure.

THE BIG BOARD