iOS Dev Accelerator
Week6 Day4

- Memory Management
- Third Party Code
- CocoaPods
- git submodules

Memory Management

- “Application memory management is the process of allocating memory during your program’s runtime, using it, and freeing it when you are done with it”
- Objective-C has two methods of application memory management:
  - Manual retain-release, or MRR, allows you to explicitly manage memory by keeping track of objects you own using reference counting.
  - Automatic Reference Counting, or ARC, uses the same reference counting that MRR does, but it inserts the appropriate memory management method calls for you at compile-time. Swift uses ARC as well.
  - The big difference between ARC and traditional garbage collectors is that ARC doesn't break memory cycles for you. ARC provides weak references to accomplish this.

Memory Problems

- There are two general problems that good memory practices will help you avoid:
  - Freeing or overwriting data that is still in use, causing corruption and crashes (dangling pointer)
  - Not freeing data that is no longer in use, which is a memory leak. Leaks needlessly increase the memory footprint of your app, often times to levels that will cause your app to be terminated.

Object Ownership

- Memory management is based on object ownership.
- An object can have many owners.
- As long as an object has one owner, it is kept alive.
- If an object has no owners, it is destroyed by the run time.

Being the owner

- You own any object you create, as long you create it using alloc, new, copy, or mutable copy.
- You can own any object by calling retain on it.
- You normally only call retain in the implementation of your init or an accessor method, or to prevent an object from being invalidated because of some other operation.

```
- (NSString *)fullName {
    NSString *string = [NSString stringWithFormat:@"%@ %@",
                                  self.firstName, self.lastName];
    return string;
}
```

We don’t own string because we didn't use alloc,new,copy

```
{
    Person *aPerson = [[Person alloc] init];
    // ...
    NSString *name = aPerson.fullName;
    // ...
    [aPerson release];
}
```

We own aPerson because we used alloc, so we had to release it when done with it

Autorelease

- You can use autorelease when you need to send a deferred release message.
- Typically when returning an object from a method.
- You need autorelease because regular release would release the object before you could return it from the method:

```
- (NSString *)fullName {
    NSString *string = [[[NSString alloc] initWithFormat:@"%@ %@",
                                        self.firstName, self.lastName] autorelease];
    return string;
}
```

Dealloc

- NSObject provides a method called dealloc.
- Dealloc is invoked automatically when an object has no owners and its memory is reclaimed.
- The role of dealloc is to free the objects own memory, and to dispose of any other objects or resources its holding onto, like properties.
- You never call dealloc directly, the system calls it for you.

Dealloc Example

```
@interface Person : NSObject
@property (retain) NSString *firstName;
@property (retain) NSString *lastName;
@property (assign, readonly) NSString *fullName;
@end

@implementation Person
// ...
- (void)dealloc
    [_firstName release];
    [_lastName release];
    [super dealloc];
}
@end
```

Accessor methods and MM

- When your class has a property thats an object, you need to make sure that object isn't released while your class is still using it.
- You need to claim ownership for this. And then you need to relinquish ownership when appropriate.
- Harness the power of accessor methods to make this simple and easy.

Accessor methods and MM

```
- (NSNumber *)count {
    return _count;
}
```

getter can just return the object

```
- (void)setCount:(NSNumber *)newCount {
    [newCount retain];
    [_count release];
    // Make the new assignment.
    _count = newCount;
}
```

setter must release the old object and retain the new

When not to use Accessor Methods

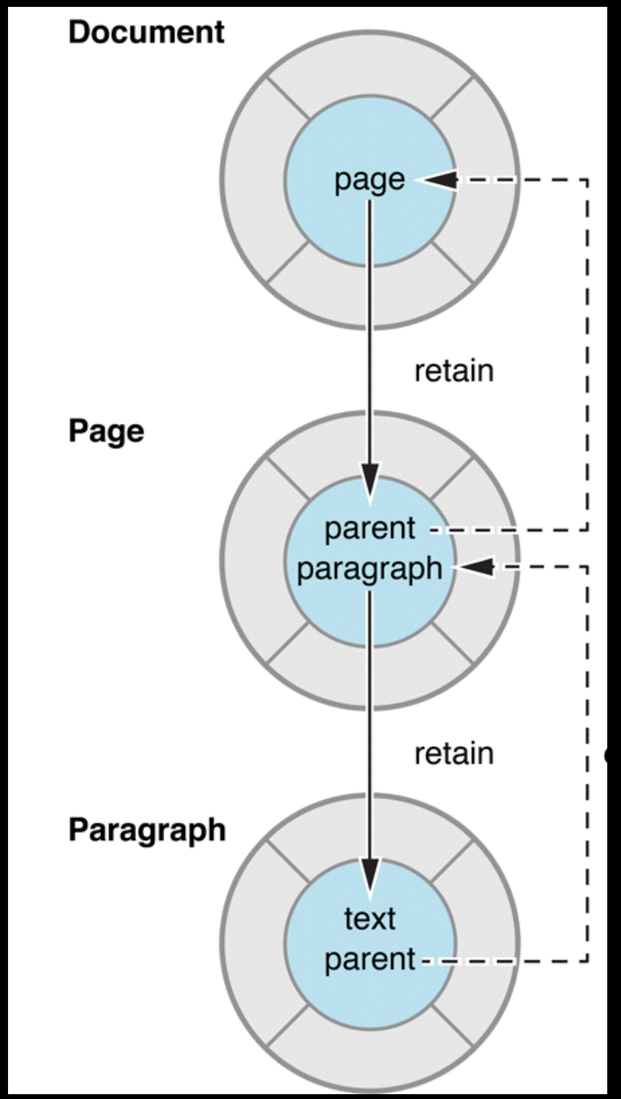
- Don’t use the accessor methods in your init methods and dealloc. This eliminates the chance of a bug related to a setter executing or accessing code that hasn't been setup yet.

```
- init {
    self = [super init];
    if (self) {
        _count = [[NSNumber alloc] initWithInteger:0];
    }
    return self;
}
```

```
- (void)dealloc {
    [_count release];
    [super dealloc];
}
```

Retain Cycles

- Retaining an object creates a strong reference to that object.
- An object cannot be dealloc'd until all of its strong references are released.
- A retain cycle happens when two objects have strong references to each other.



Use weak references to avoid retain cycles

- A weak reference is a non-owning relationship where the source object does not retain the object to which it has a reference.
- Cocoa conventions dictate that parent objects should have strong references to their children, and children have weak references to their parents.
- Examples of weak references in Cocoa: data sources, delegates, and notification observers.
- Thats why you need to specifically unregister for notifications when your object is about to be released, since the notification center only keeps weak references to objects who sign up for notifications. If you didn't unregistered, the notification center may try to deliver a notification to a released object. CRASH

Keeping objects alive while in use

- Objects can be released at any time.
- Like when an object's parent is released, and the parent was the only owner of the child, the child is released too.
- Collections own the objects they contain. When an object is removed from a collection like an array or dictionary, if the collection was the only owner then the object is released.
- So when you really need to keep an object alive while in use, call retain on it, execute your code, and then release it.

Retain count

- Ownership is implemented through something called reference counting.
- Every object has a retain count.
- When you create an object it has a retain count of 1.
- When an object has retain called on it, its retain count is incremented by 1.
- When an object has release called on it, its retain count is reduced by 1.
- When you an object has autorelease called on it, its retain count is reduced by 1 at the end of the current autorelease pool block.
- If an object's retain count is reduced to zero, it is released.
- **You should never need to manually access an object's retain count; The value returned is not accurate.**

AutoRelease Pool Blocks

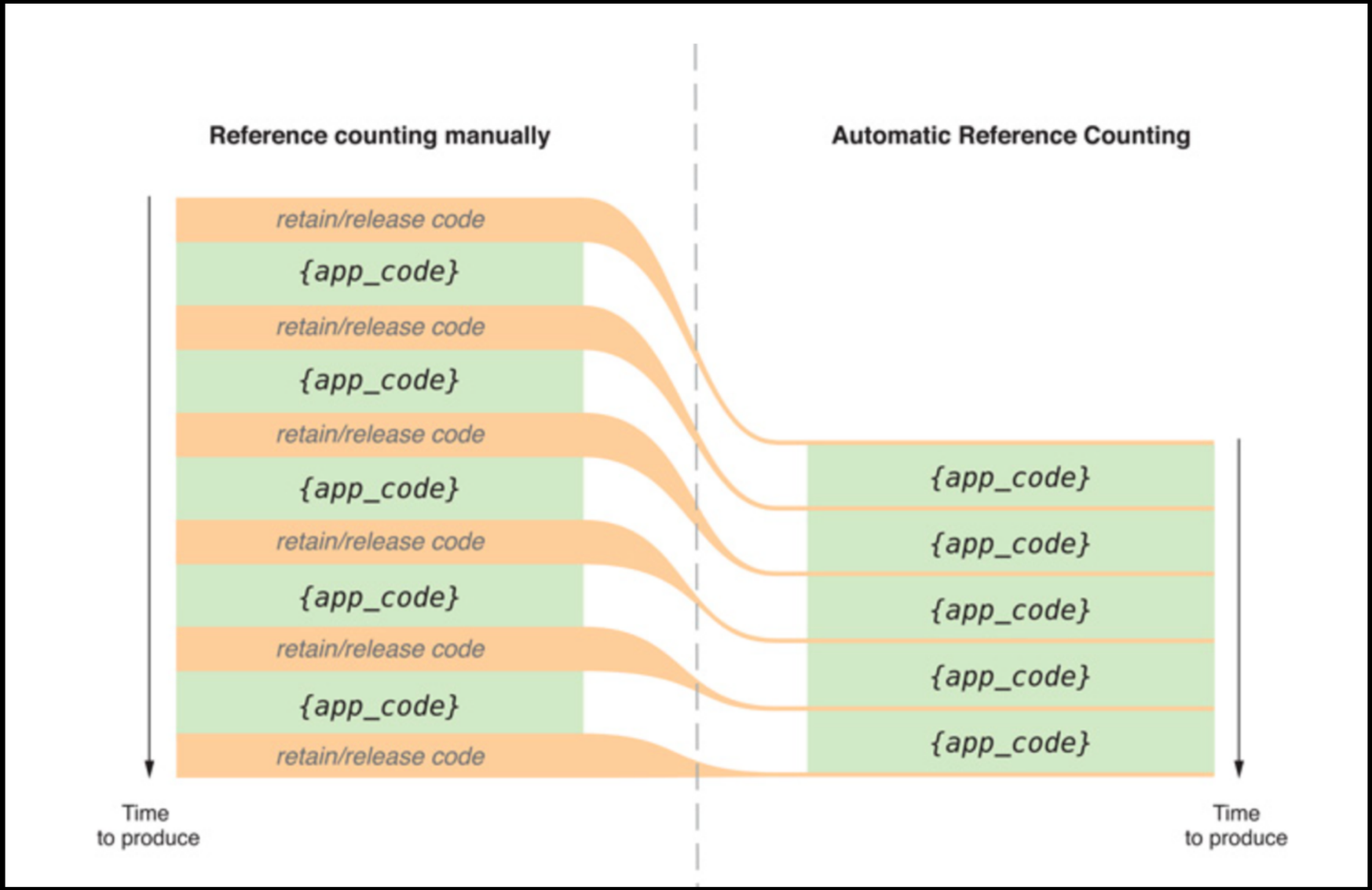
- “Autorelease pool blocks provide a mechanism whereby you can relinquish ownership of an object, but avoid the possibility of it being deallocated immediately (such as when you return an object from a method)”
- You usually don't need to create your own.
- 3 common scenarios when you create one:
  - If you are writing a command-line tool.
  - You write a loop that creates many temporary objects.
  - If you spawn a secondary thread.

AutoRelease Pool Blocks

```
for (NSURL *url in urls) {

    @autoreleasepool {
        NSError *error;
        NSString *fileContents = [NSString stringWithContentsOfURL:url
                                          encoding:NSUTF8StringEncoding error:&error];
        /* Process the string, creating and autoreleasing more objects. */
    }
}
```

ARC


Reference counting manually
Automatic Reference Counting
retain/release code
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Time to produce
Time to produce

Automatic Reference Counting (ARC)

- ARC enforces new rules: You cannot invoke dealloc, retain,release,retainCount, or autorelease.
- ARC introduced weak and strong property attributes. Strong is the default.
- You can explicitly create weak references with __weak qualifier while declaring a variable.
- Compiler will insert appropriate memory management calls for you.

ARC

```
// The following declaration is a synonym for: @property(retain) MyClass *myObject;
@property(strong) MyClass *myObject;

// The following declaration is similar to "@property(assign) MyClass *myObject;"
// except that if the MyClass instance is deallocated,
// the property value is set to nil instead of remaining as a dangling pointer.
@property(weak) MyClass *myObject;
```

Weak self and blocks

- When referring to self inside a block (or closure), best practice is to create a weak reference in self before the block and use that reference instead of self.
- Since blocks and closures capture strong references to all objects accessed in their bodies, if the object represented by self were to get a strong pointer to the block or closure, then we would have a retain cycle.

Blocks and __weak self

- Be careful accessing self inside a block, or you could create a retain cycle
- Use __weak self and __strong self to avoid this
- You may see this referred to as the @weakify pattern

http://aceontech.com/objc/ios/2014/01/10/weakify-a-more-elegant-solution-to-weakself.html

Blocks and __weak self

```
// Create a weak reference to self
__weak typeof(self)weakSelf = self;

[self.context performBlock:^{
    // Create a strong reference to self, based on the previous weak reference.
    // This prevents a direct strong reference so we don't get
    // into a retain cycle to self.
    // Also prevents self from becoming nil half-way through execution.

    __strong typeof(weakSelf)strongSelf = weakSelf;

    // Do something else

    NSError *error;
    [strongSelf.context save:&error];

    // Do something else
}];
```

CocoaPods

- Dependency manager for Objective-C
- Automates process of using 3rd-party libraries
- Written in ruby and distributed as a rubygem
- Has a rich ecosystem and a zealot-like following

http://cocoapods.org

CocoaPods

- Install cocoapods globally on your system.

```
sudo gem install cocoapods
pod setup
```

- Create a podfile local to your project

```
touch Podfile
open -e Podfile

pod init
```

- Specify your project dependancies.

Podfile

- Each `pod` entry in the Podfile specifies a library and an optional version to install

```
# Uncomment this line to define a global platform for your project
platform :ios, "7.0"

pod 'AFNetworking'
pod 'Mantle'
pod ‘libextobjc/EXTScope'
pod 'hpple', '~> 0.2.0’
```

CocoaPods

- After creating your Podfile, it's time to install

```
pod install
```

- You can update your install pods too

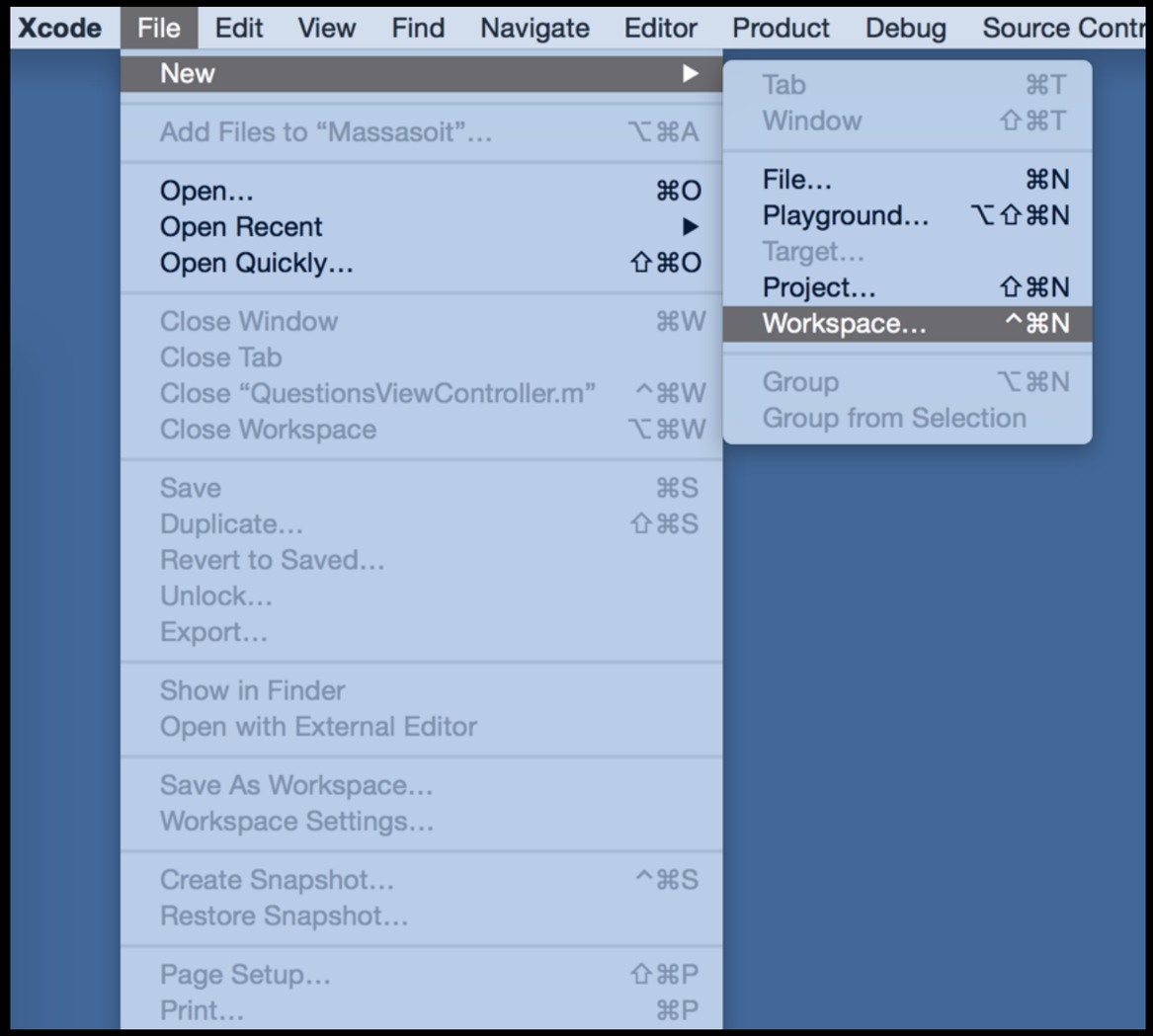
```
pod update
```

- CocoaPods will create a workspace that includes your Pods

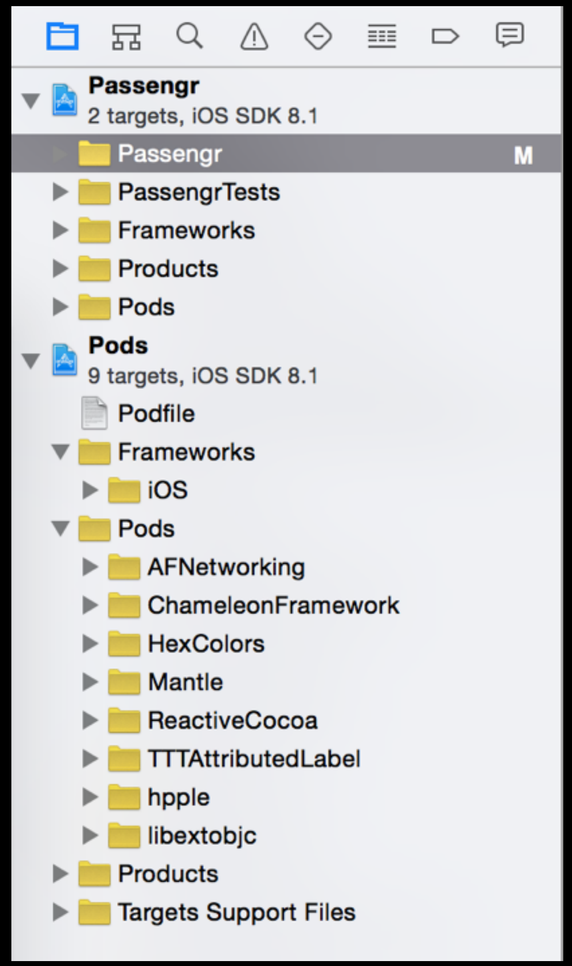
What is Xcode Workspace?

- A workspace is an Xcode document that groups projects and other documents so you can work on them together
- Can contain any number of Xcode projects or other dependencies
- Easy way to combine code from multiple sources into one app
- Looks and feels like usual Xcode projects, but with nested projects inside.

File > New > Workspace



One Workspace, Many Targets



- CocoaPods creates a Pods project
- Any Pod you install will be added automatically as another target
- The Pods project will be a dependency of you App. You need the Pods to compile.

Finding Pods?

- By searching on cocoapods.org
- Look for UI widgets on cocoacontrols.com
- Many iOS projects on GitHub reference a Pod name. See the README.

CocoaPods and Swift?

- CocoaPods doesn’t work will Swift right now
- However, using third party Swift code is easy
- Copy the .swift file into your project
- http://www.swifttoolbox.io
- You can also use a Bridging-Header to import a CocoaPod

Using git submodules

- Submodules allow a git repository to be kept as subdirectory within another git repository
- Clone another repository into your project and keep your commits separate
- Pull in changes and update the submodule as original repository evolves

Using git submodules

- Add a submodule to an existing repo using the add command
  - git submodule add project_url
- A .gitmodules file will be created with a reference to the new module
- This file should be checked into and tracked in your repo
- The .gitmodules file spells out the required git modules your project depends on

Using git submodules

- Checkout a project and its required submodules

```
git clone https://github.com/chaconinc/MainProject

cd MainProject

git submodule init

git submodule update
```

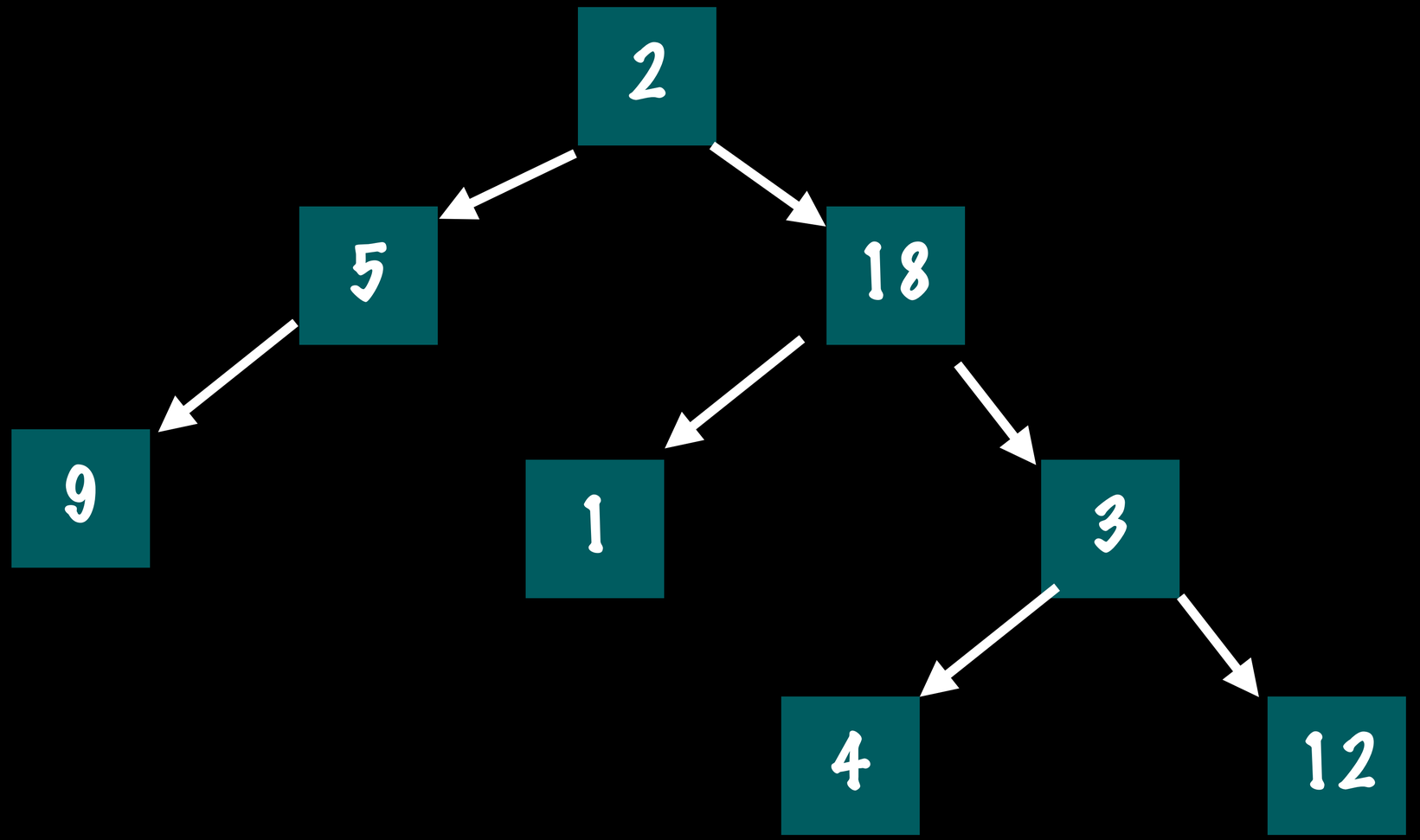
- Alternatively, clone an entire repository recursively

```
git clone --recursive https://github.com/chaconinc/MainProject
```

Tree Data Structure

- Hierarchical structure with root node and subtrees and children
- Can be ordered or unordered
- Each element or node in the tree has a value and pointers to zero or more children nodes
- Binary Tree is a specialized type of Tree, where each node has at most **two** children.

Tree Data Structure



Binary Search Tree (BST)

- An ordered or sorted binary tree
- Each node has a comparable key or value
- The key in any node is larger than the keys in all nodes in that node's left sub-tree
- The key in any node is smaller than the keys in all nodes in that node's right sub-tree

Binary Search Tree Properties

- The left subtree of a node contains only nodes with keys less than the node's key.
- The right subtree of a node contains only nodes with keys greater than the node's key.
- The left and right subtree each must also be a binary search tree.
- Each node can have up to two successor nodes.
- There must be no duplicate nodes.
- A unique path exists from the root to every other node.

Binary Search Tree