Memory Management

Giftbot

Memory Management without ARC

1. GC (Garbage Collection)

- 정기적으로 Garbage Collector 가 동작하여 더이상 사용되지 않는 메모리를 반환하는 방식
- OS X 에서만 지원했었으나 버전 10.8 (Mountain Lion) 부터 deprecated

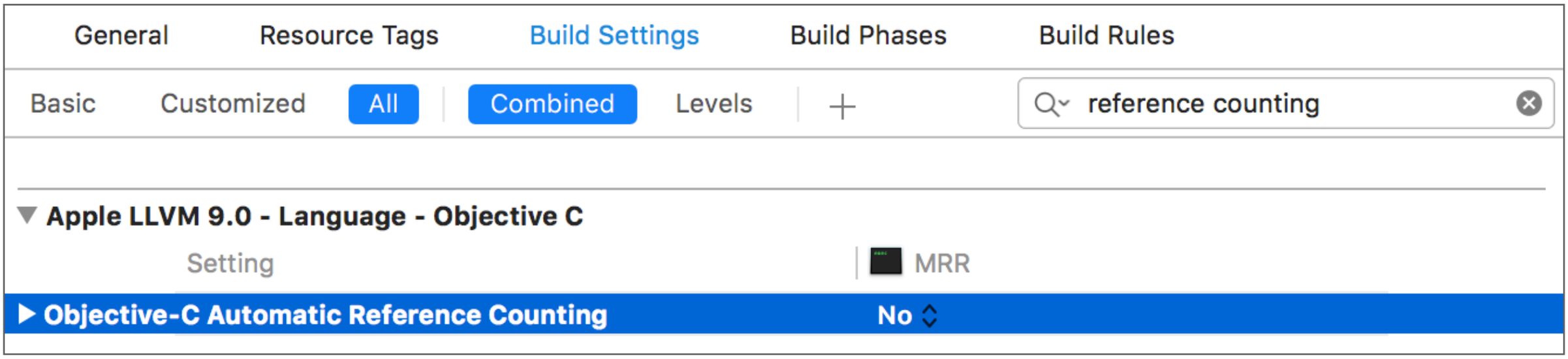
2. MRR (Manual Retain-Release) / MRC (Manual Referece Counting)

- RC(Reference Counting) 를 통해 메모리를 수동으로 관리하는 방식
- retain / release / autorelease 등의 메모리 관리 코드를 직접 호출
- 개발자가 명시적으로 RC 를 증가시키고 감소시키는 작업 수행

MRR

RC 에 대한 이해 필요 (Reference Counting / Retain Count / Reference Count)

Objective-C 에서는 ARC 해제 가능



Reference Counting

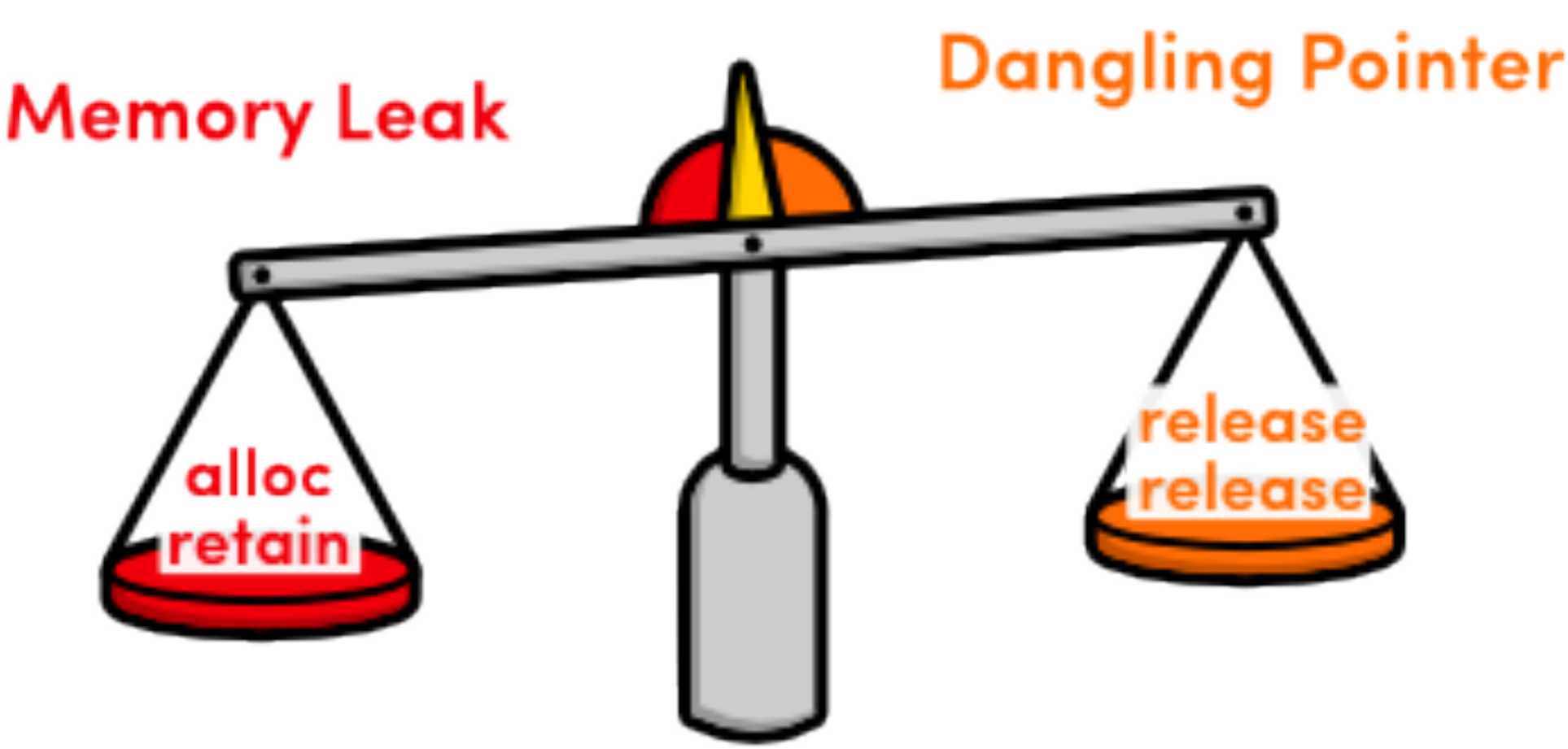
```
int main(int argc, const char * argv[]) {

    Person *man = [[Person alloc] init];          ——— count : 1
    [man doSomething];

    [man retain];                                 ——— count : 2
    [man doSomething];

    // [man release];
    [man doSomething];                            ——— count : 2
    [man release];                                ——— count : 1
    [man release];                                ——— count : 0
    return 0;
}
```

Leak vs Dangling Pointer

카운트 할당과 해제는 균형이 맞아야 함

- alloc , retain 이 많을 경우는 Memory Leak 발생

- release 가 많을 경우 Dangling Pointer (허상, 고아) 발생



MemoryManagement Is Hard

- Lots of rules and conventions
- High hurdles for new developers
- Constant attention for existing developers
- Requires perfection

MemoryManagement Is Hard

- Instruments
  - Allocations, Leaks, Zombies
- Xcode Static Analyzer
- Heap
- ObjectAlloc
- vmmap
- MallocScribble
- debugger watchpoints
- …and lots more

Programming with Retain/Release

Xcode Static Analyzer

```
NSObject *objectID = 0;

for (NSUInteger i=0; i < count; ++i) {          Looping back to the head of the loop

    NSObject *object = [trackedElements objectAtIndex:i];

    if ([object isMemberOfClass:[NSString class]])
    {
        objectID = [[NSString alloc] initWithString:aString];
    }                                           Method returns an Objective-C object with a +1 retain count (owning reference)

    if (objectID != nil)
    {
        [objectID release];                     Object released
    }                                           Reference-counted object is used after it is released
}
```

ARC

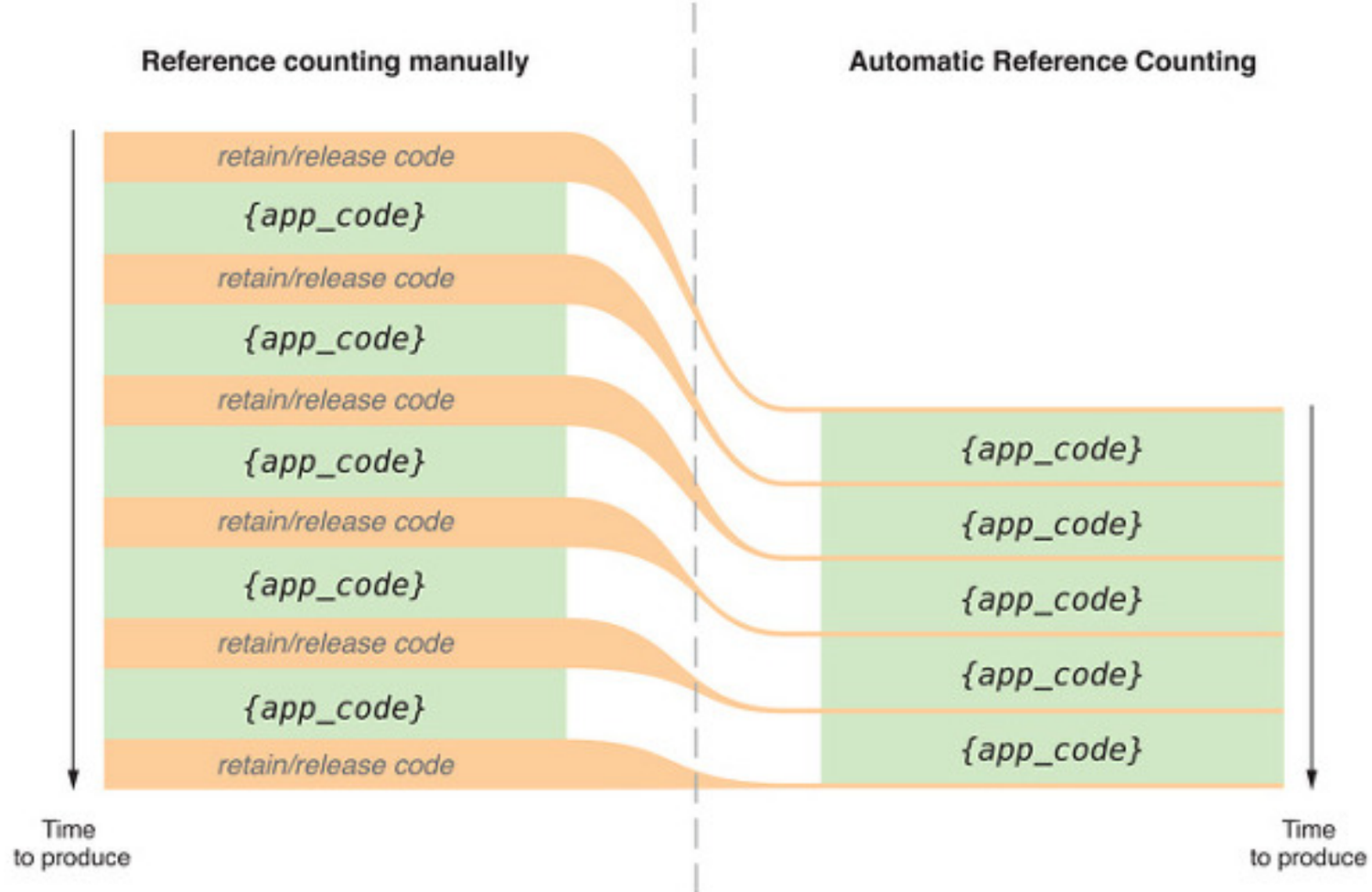
ARC (Automatic Reference Counting)

RC 자동 관리 방식 (WWDC 2011 발표)

컴파일러가 개발자를 대신하여 메모리 관리 코드를 적절한 위치에 자동으로 삽입

GC 처럼 런타임이 아닌 컴파일 단에서 처리 (Heap 에 대한 스캔 불필요 / 앱 일시 정지 현상 없음)

메모리 관리 이슈를 줄이고 개발자가 코딩 자체에 집중할 수 있도록 함



ARC (Automatic Reference Counting)

ARC 는 클래스의 인스턴스에만 적용　(Class - Reference 타입 , Struct / Enum - Value 타입)

활성화된 참조카운트가 하나라도 있을 경우 메모리에서 해제 되지 않음

참조 타입

- 강한 참조 (Strong) : 기본값. 참조될 때마다 참조 카운트 1 증가

- 약한 참조 (Weak), 미소유 참조 (Unowned) : 참조 카운트를 증가시키지 않음

강한 순환 참조 (Strong Reference Cycles) 에 대한 주의 필요

	Var	Let	Optional	Non-Optional
Strong	👍	👍	👍	👍
Weak	👍	⛔	👍	⛔
Unowned	👍	👍	⛔	👍

```
// Reference Counting
// Class

class Point {
    var x, y: Double
    func draw() { … }
}


let point1 = Point(x: 0, y: 0)
let point2 = point1
point2.x = 5
// use `point1`
// use `point2`
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// Class (generated code)

class Point {
    var refCount: Int
    var x, y: Double
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let point1 = Point(x: 0, y: 0)
let point2 = point1
retain(point2)
point2.x = 5
// use `point1`
release(point1)
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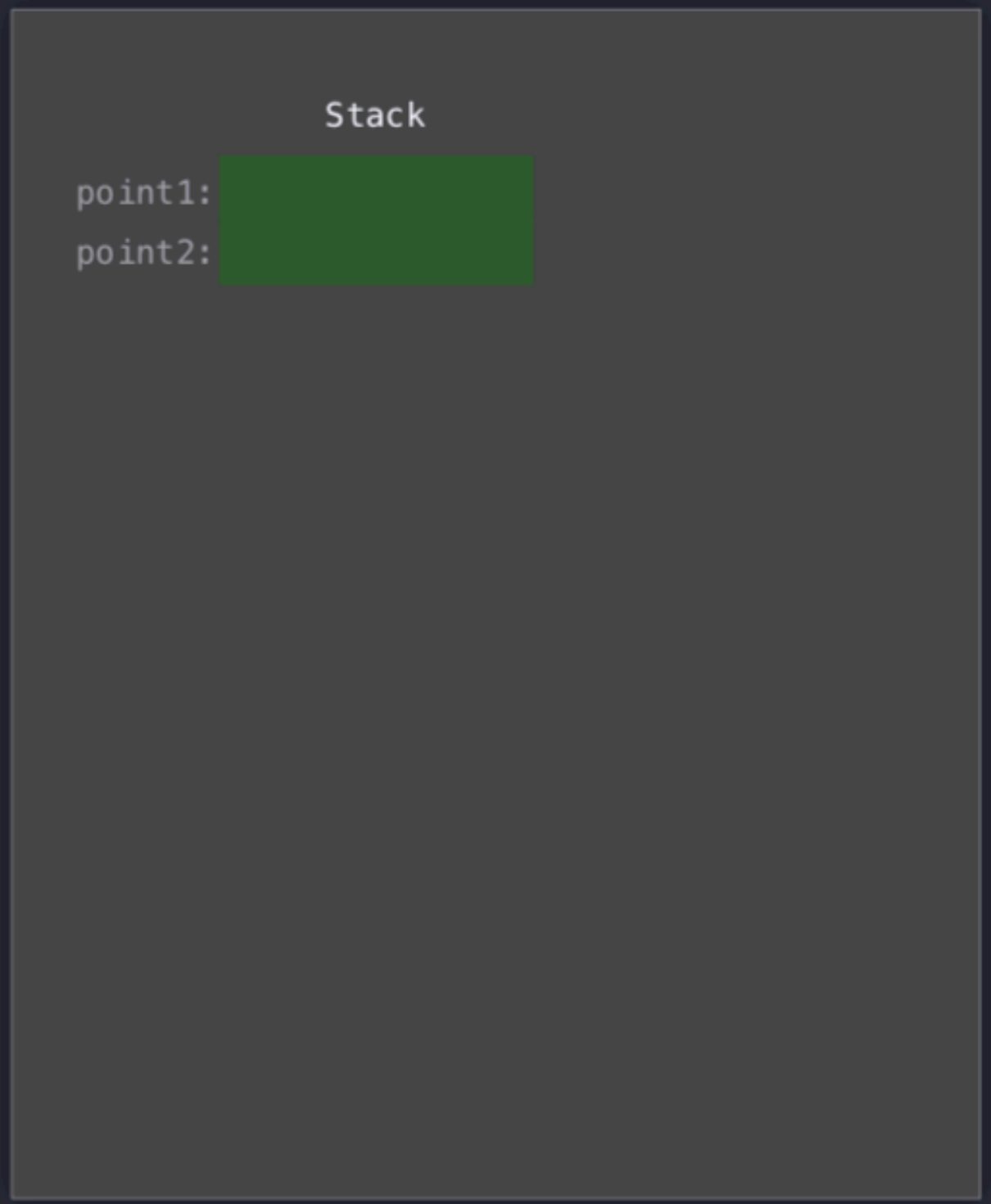

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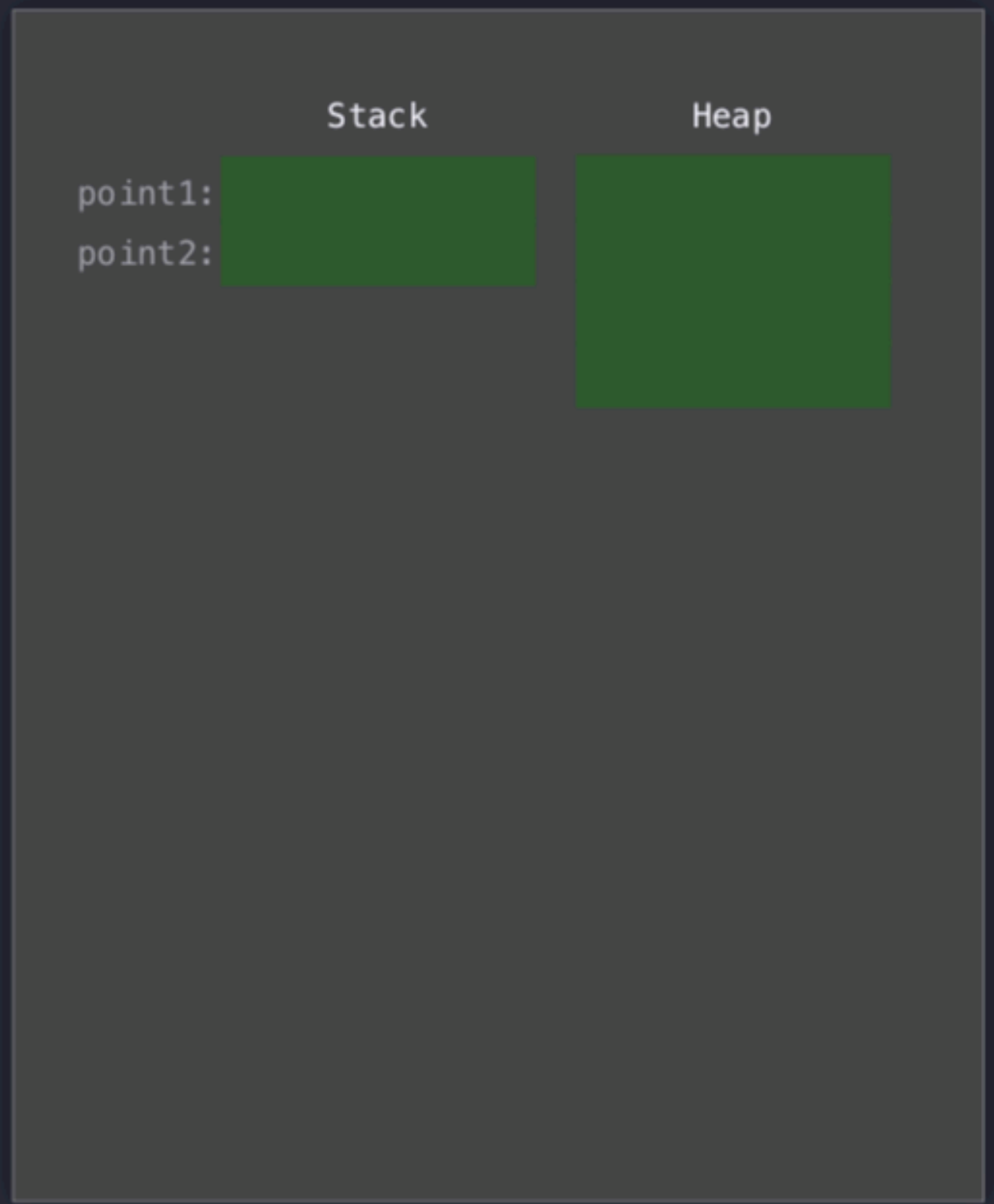

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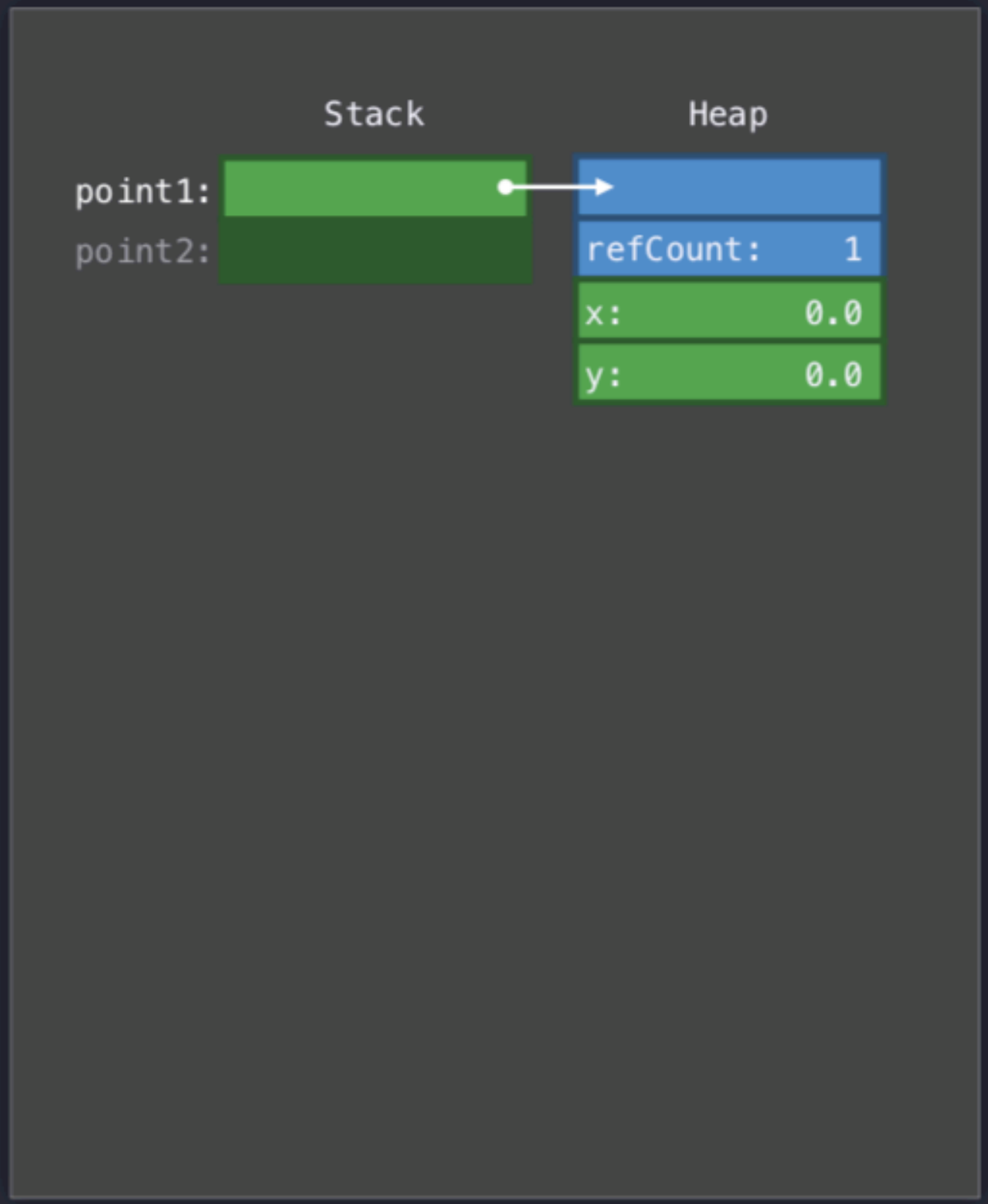

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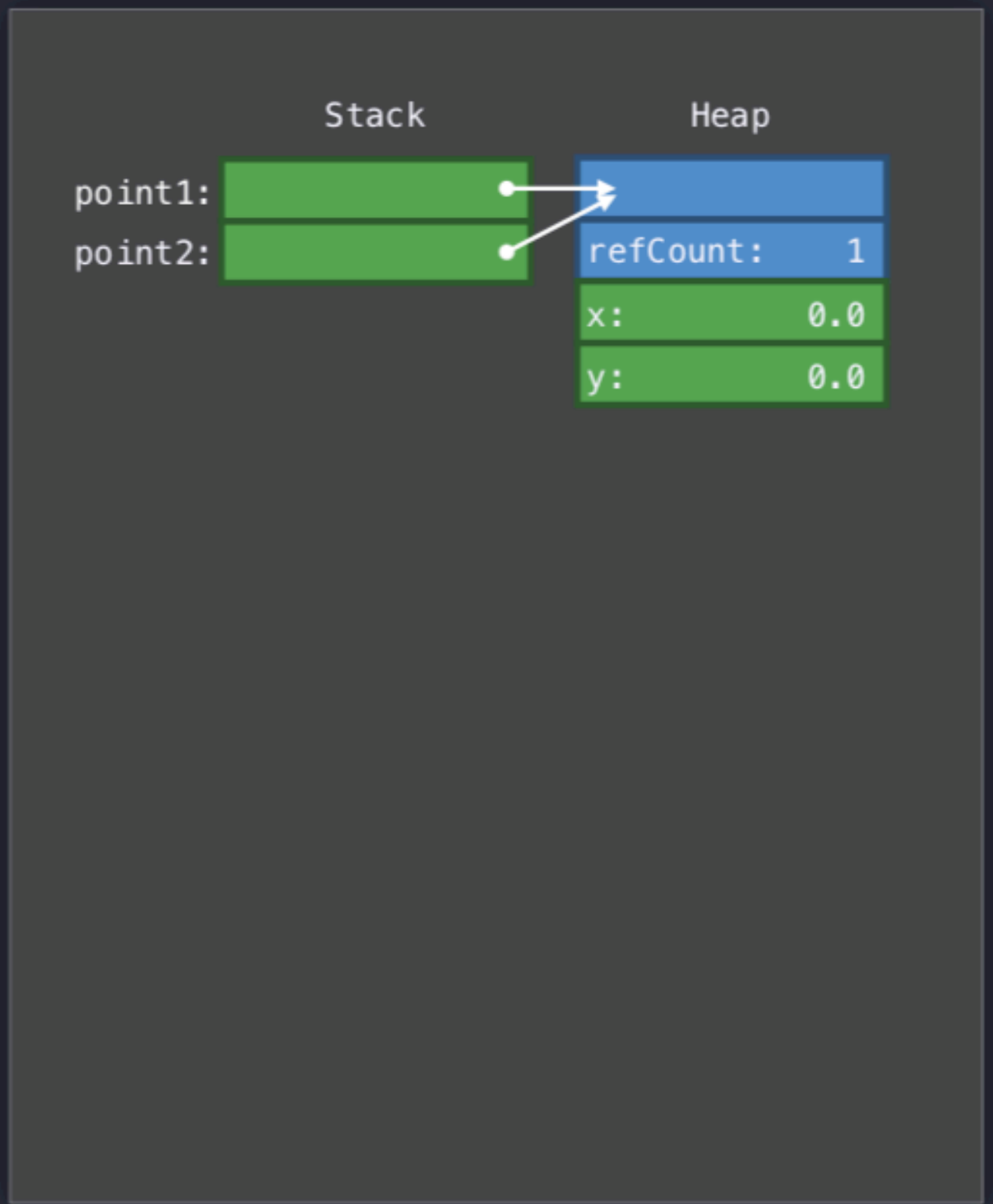

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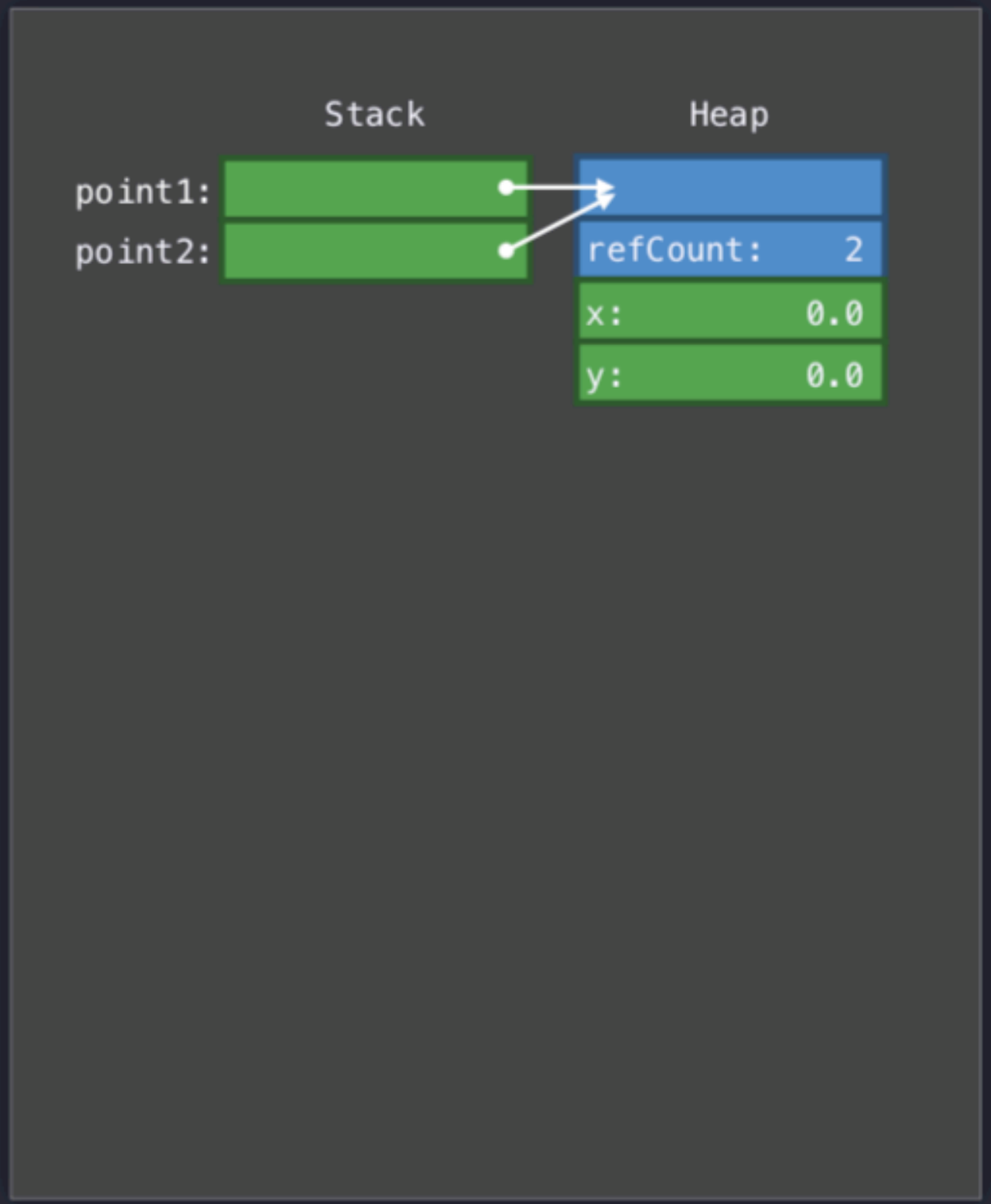

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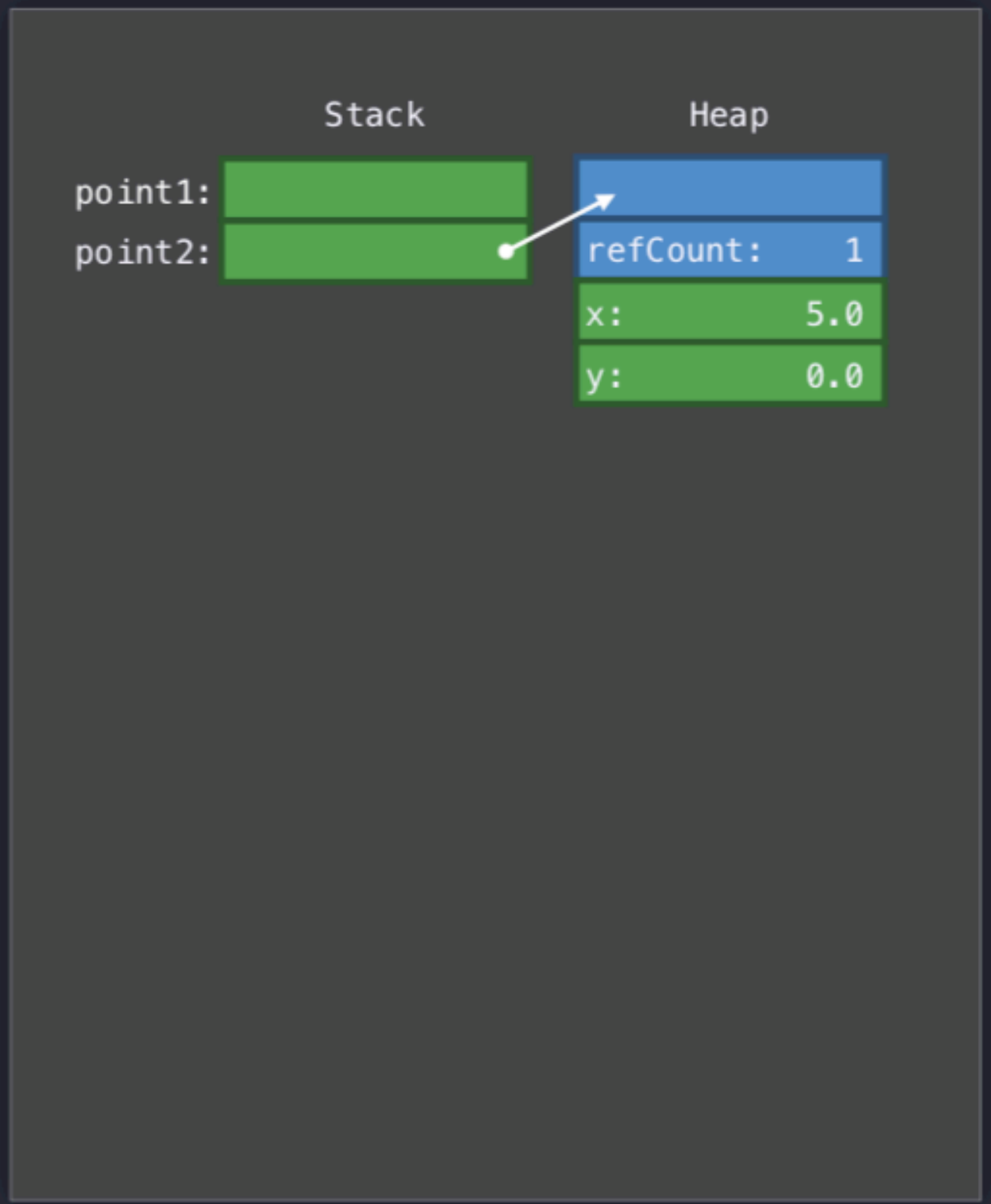

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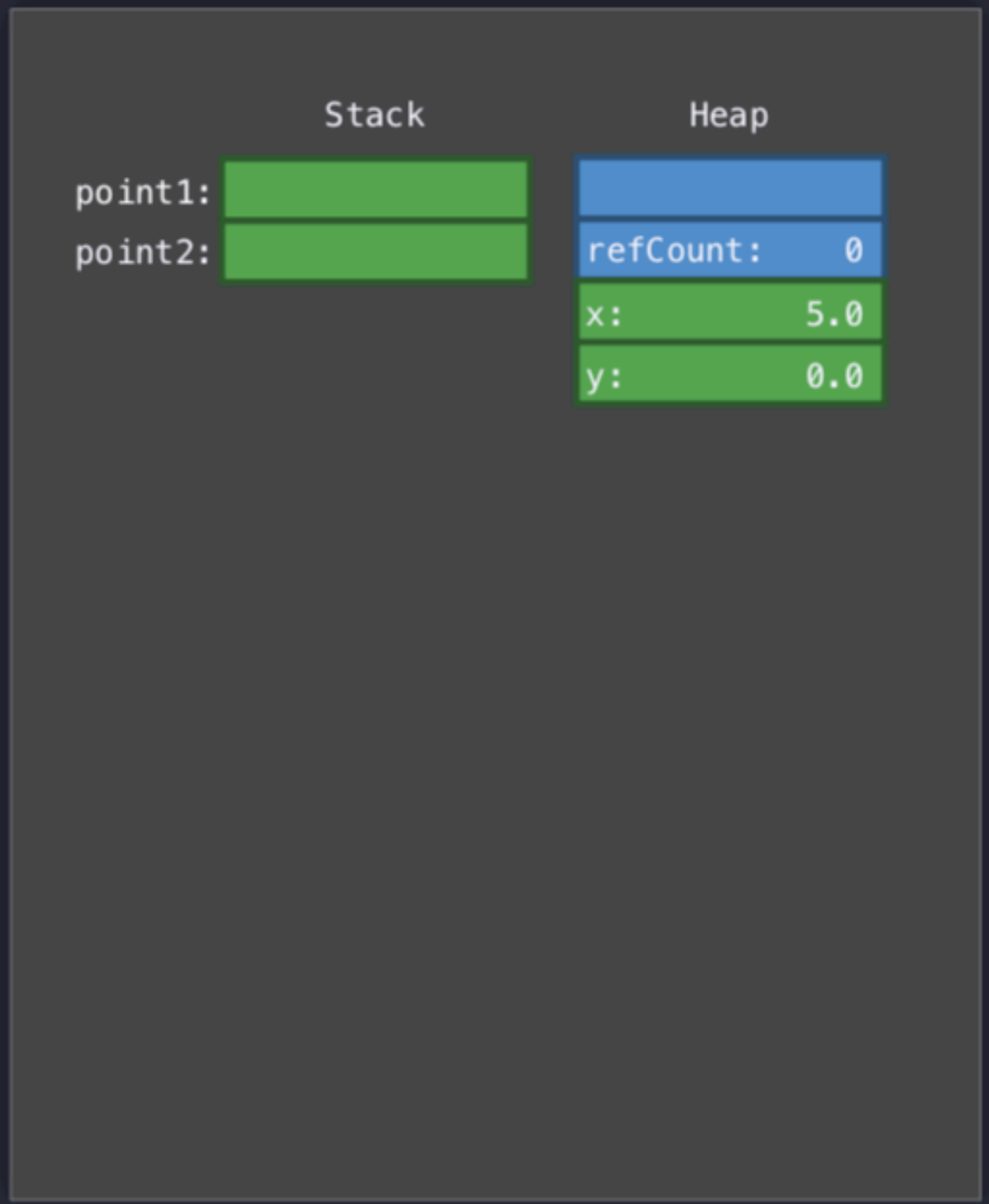

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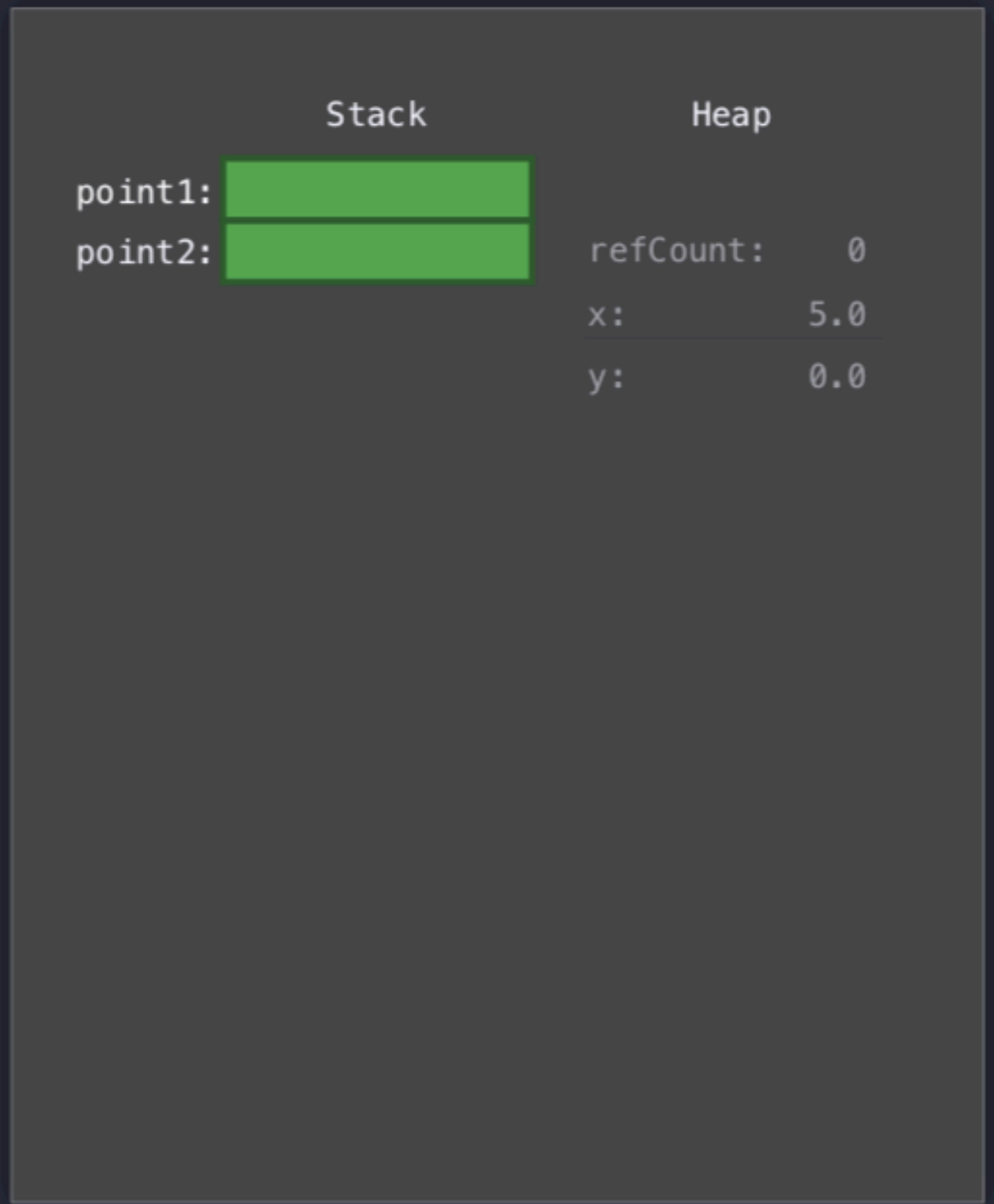

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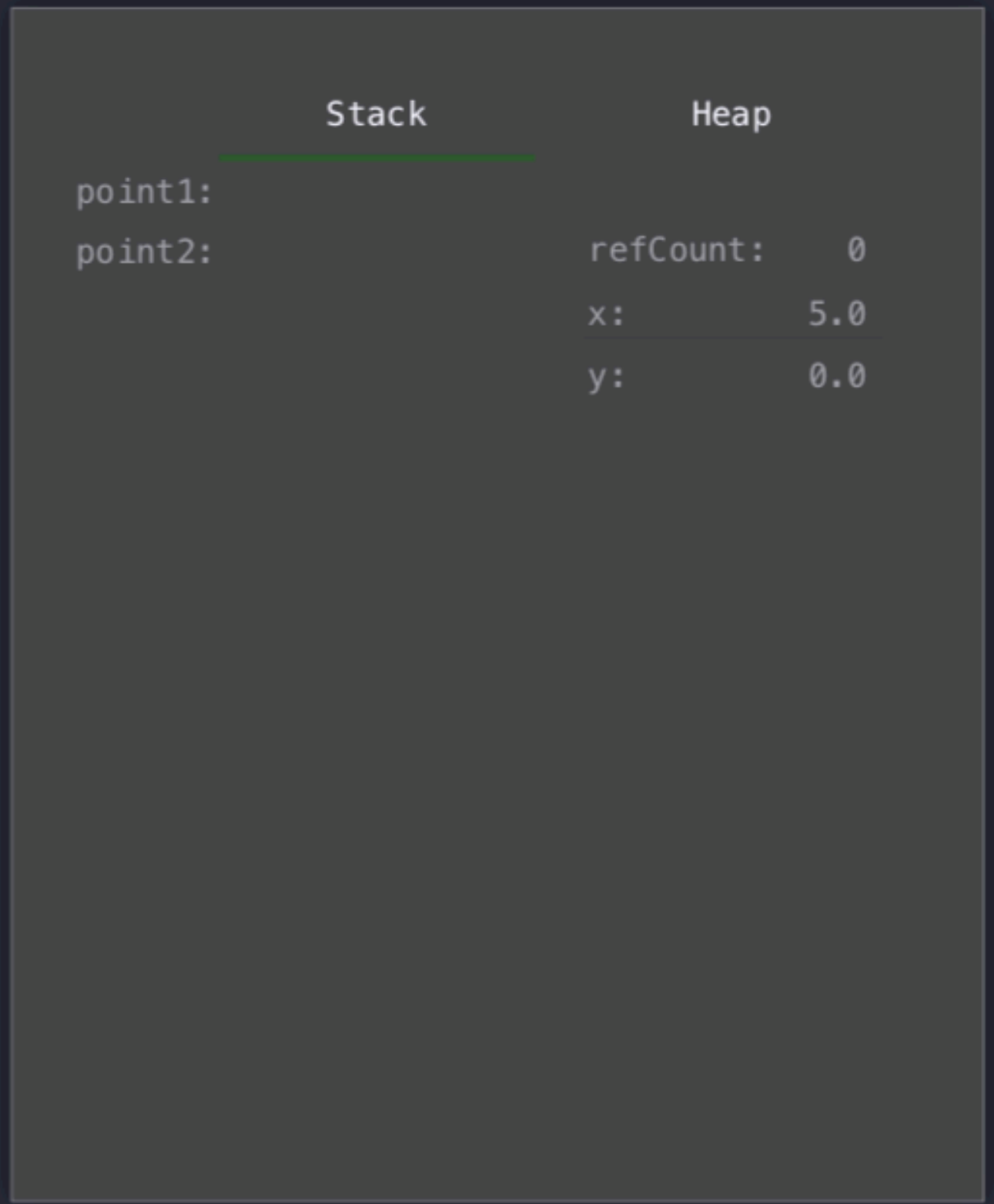

ARC in Struct ?

```
// Allocation
// Struct

struct Point {
    var x, y: Double
    func draw() { … }
}

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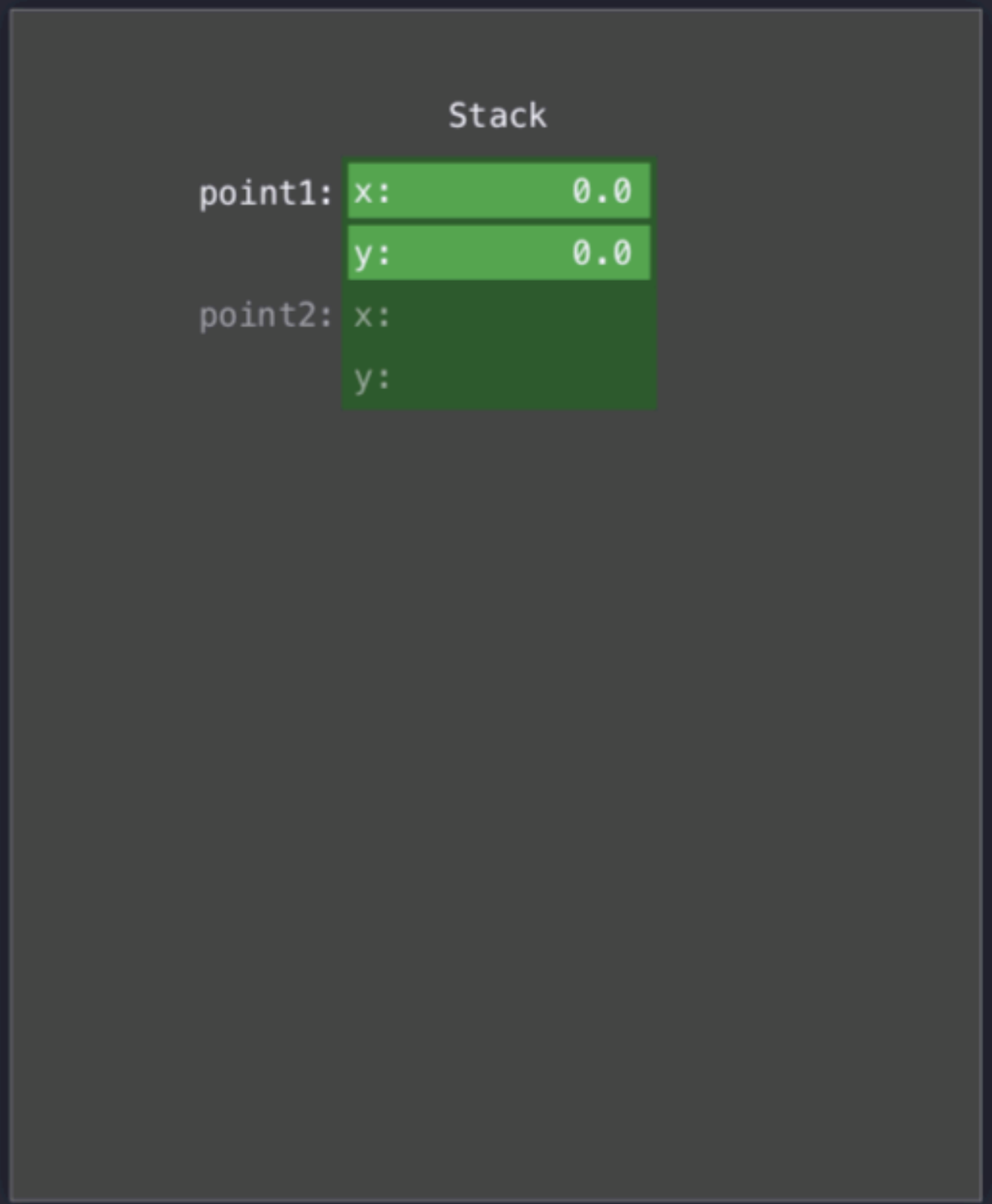

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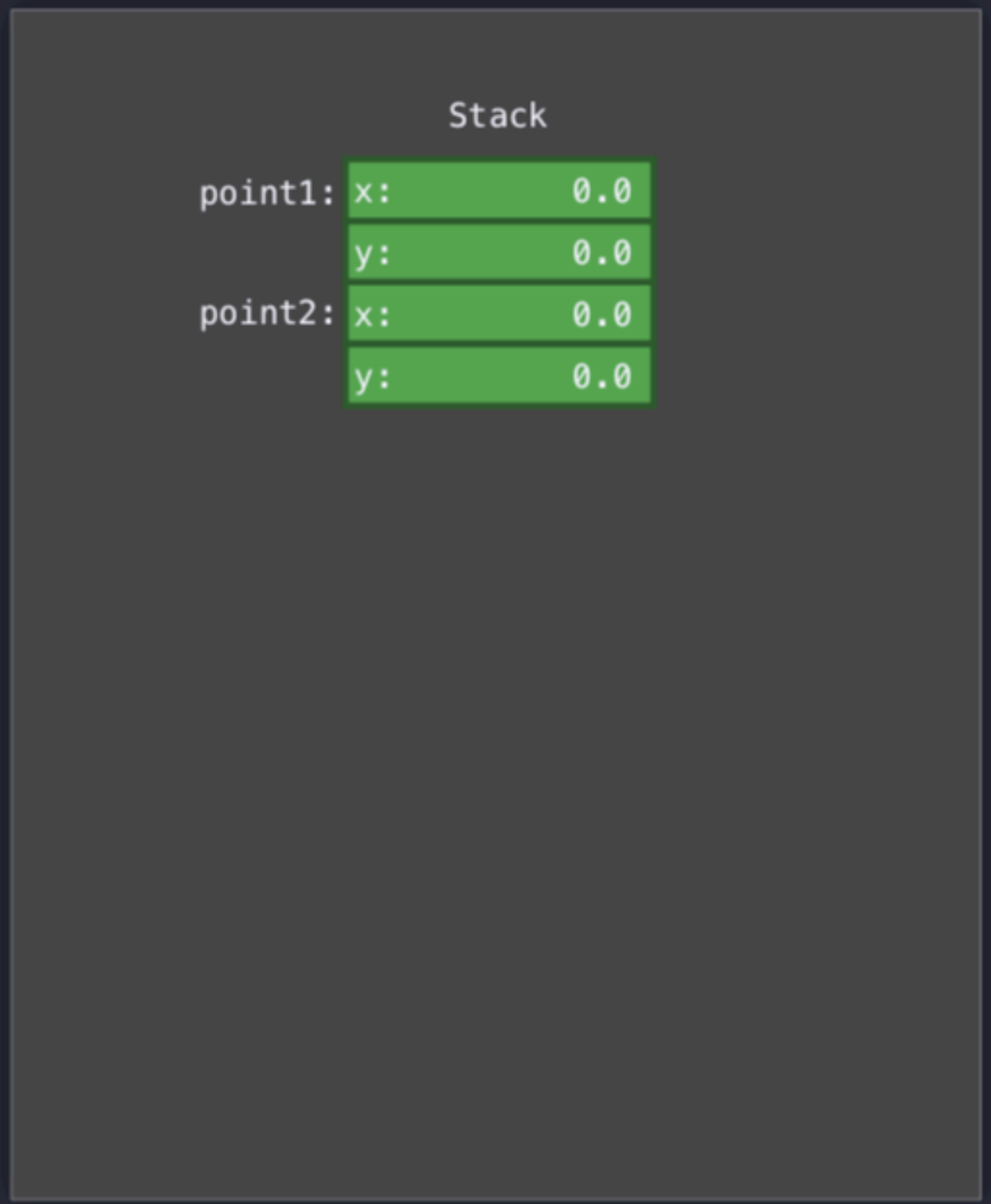

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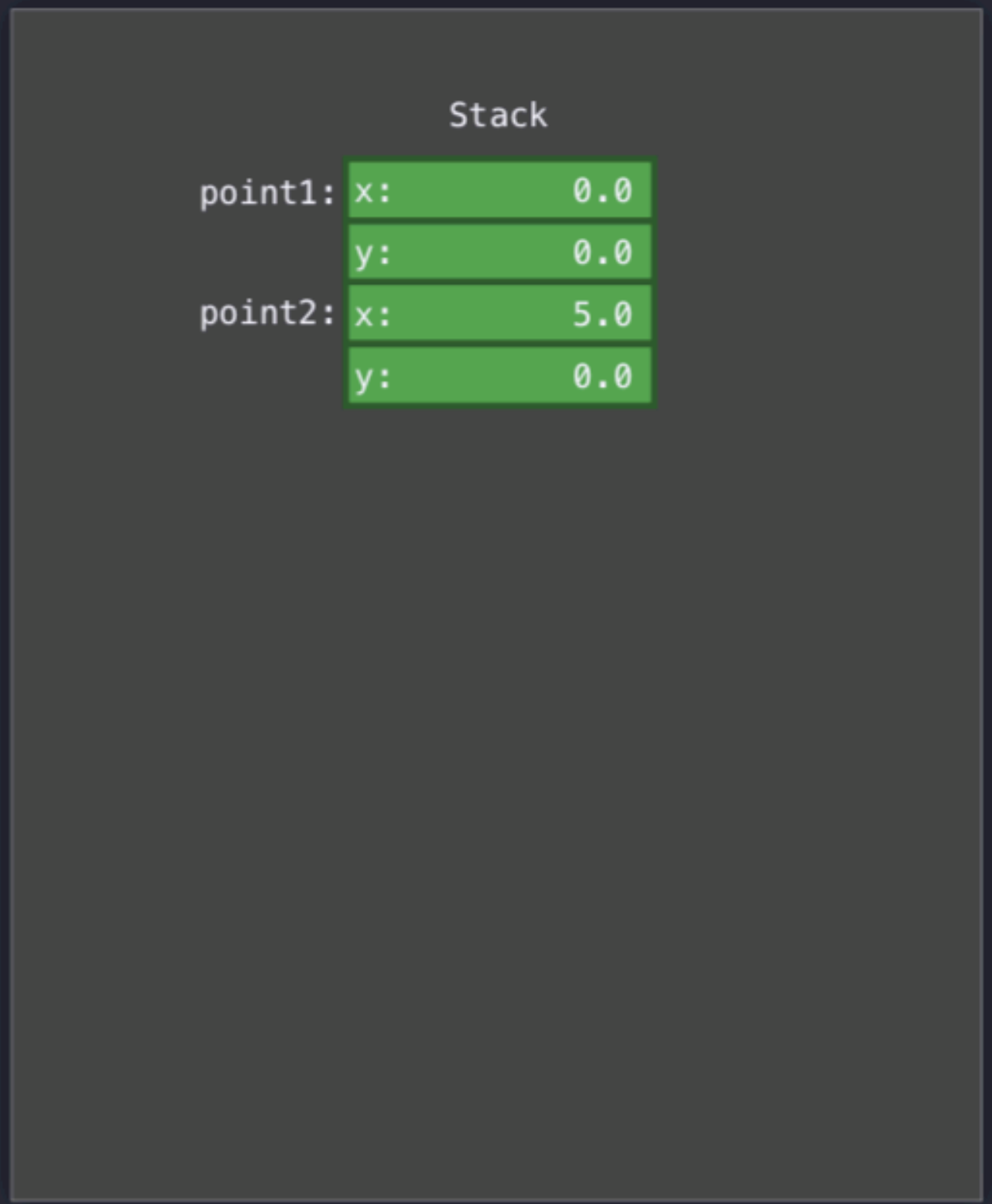

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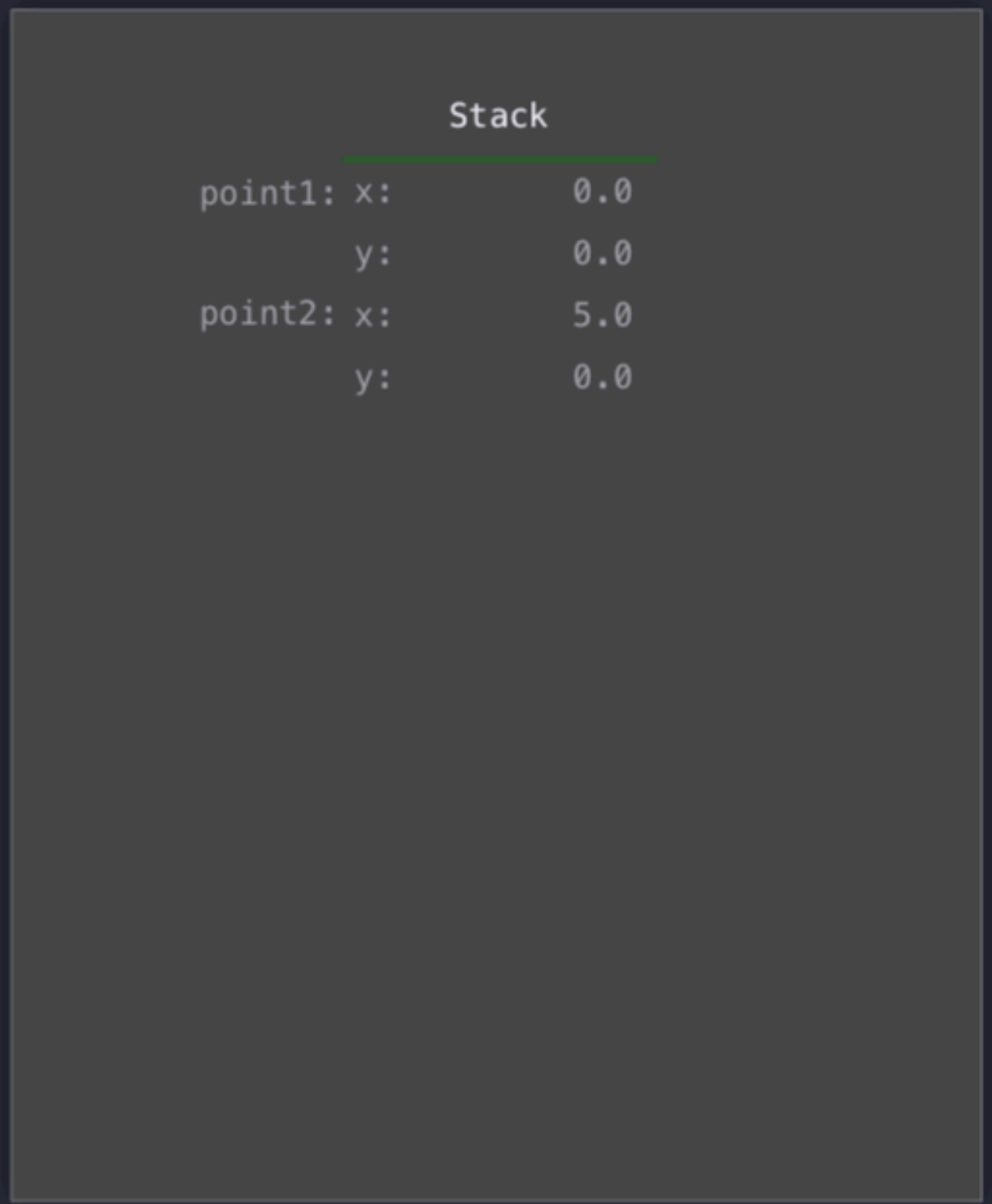
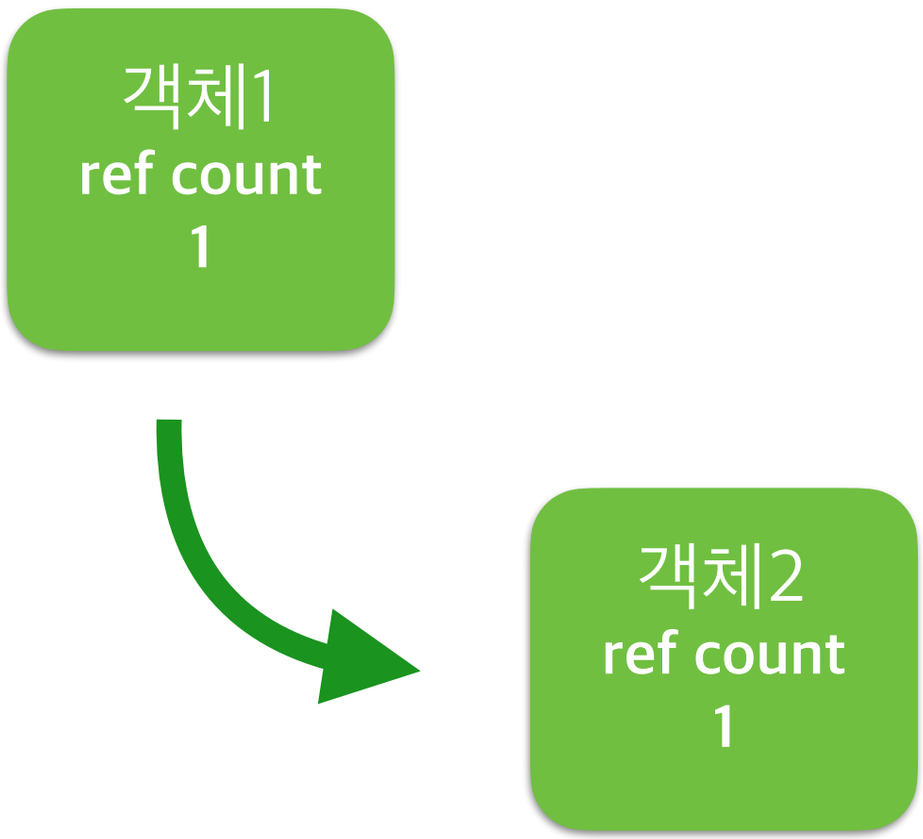


Strong Reference Cycle

Strong Reference Cycle

- 객체에 접근 가능한 모든 연결을 끊었음에도 순환 참조로 인해
  활성화된 참조 카운트가 남아 있어 메모리 누수가 발생하는 현상
- 앱의 실행이 느려지거나 오동작 또는 오류를 발생시키는 원인이 됨

Strong Reference Cycle



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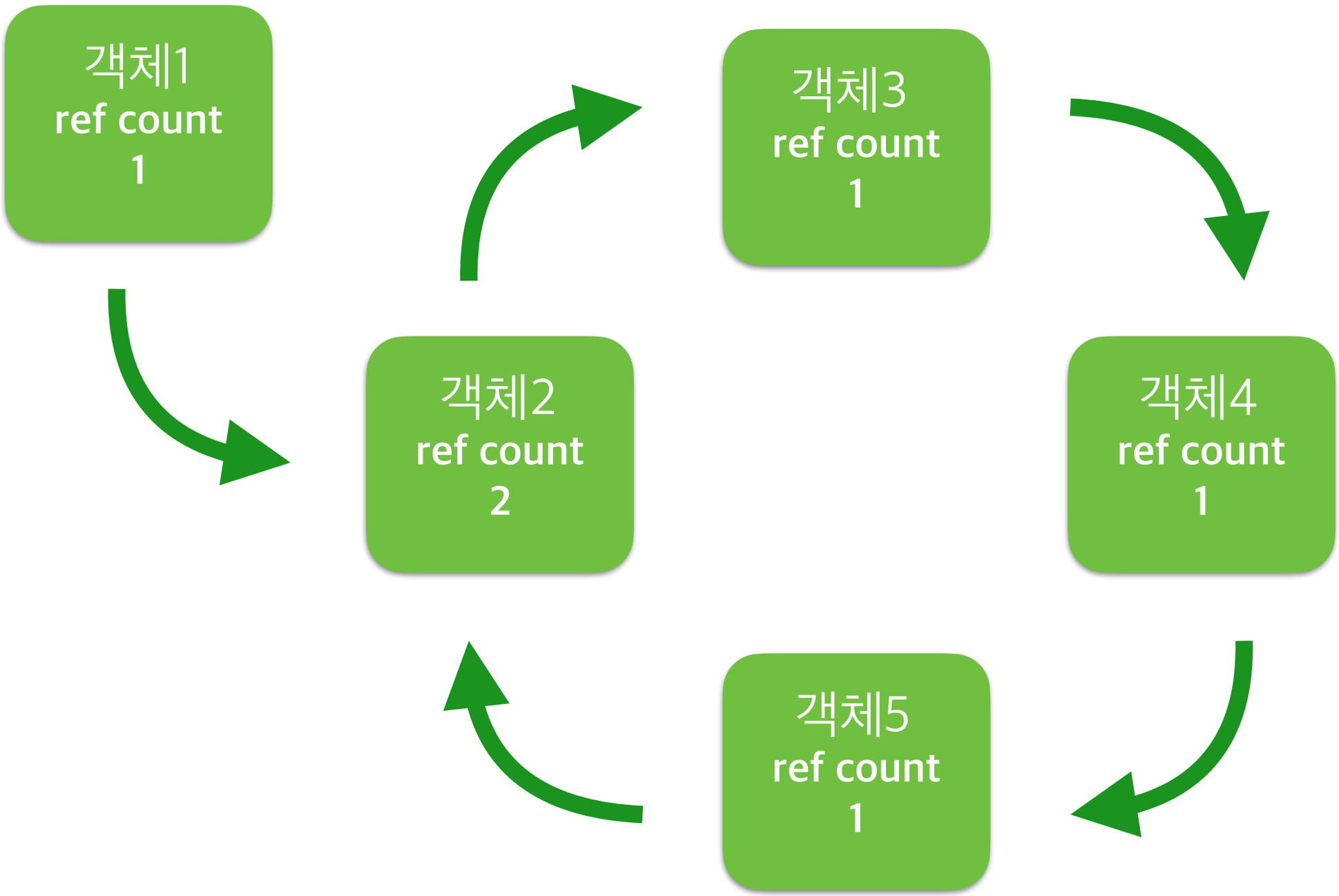

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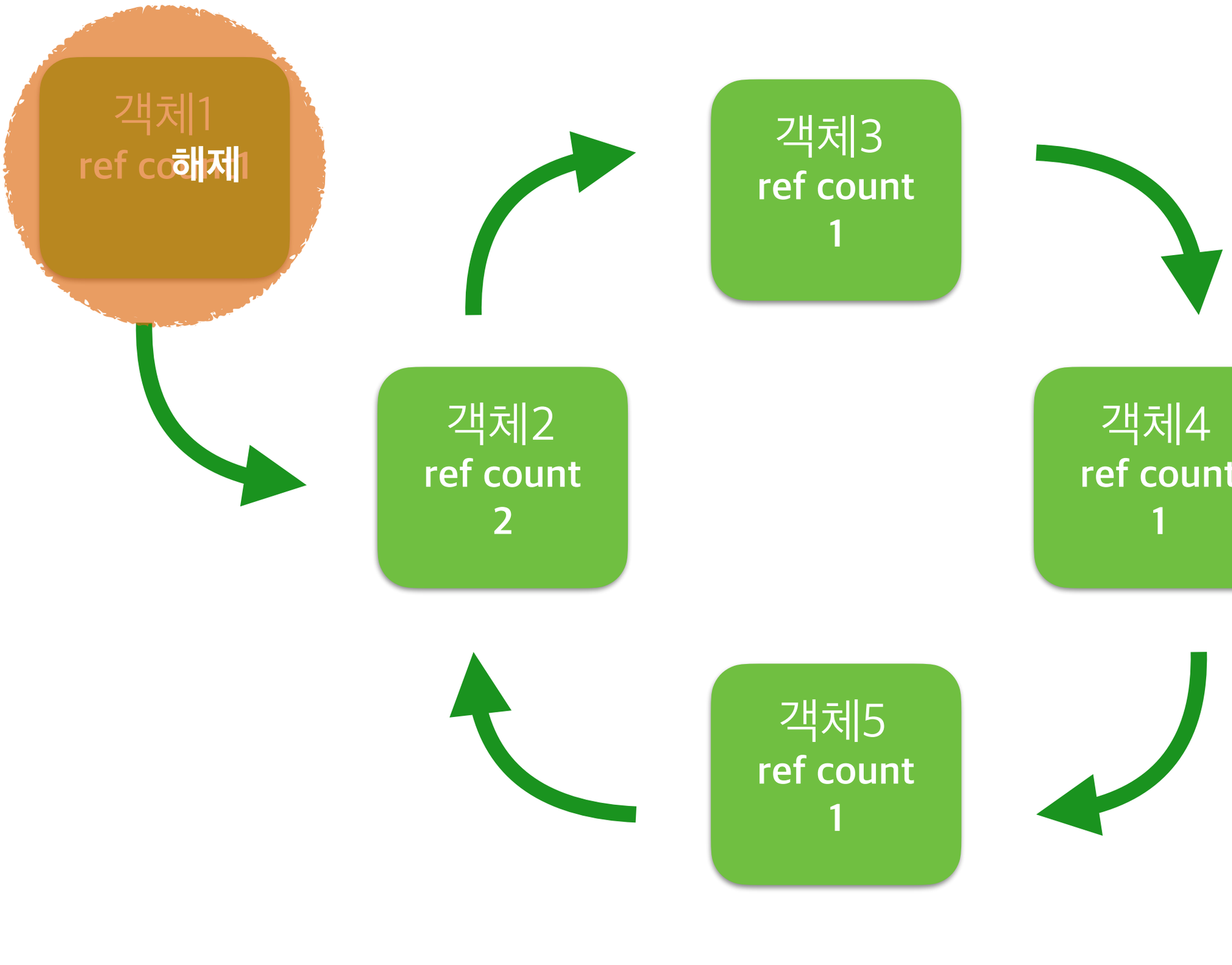

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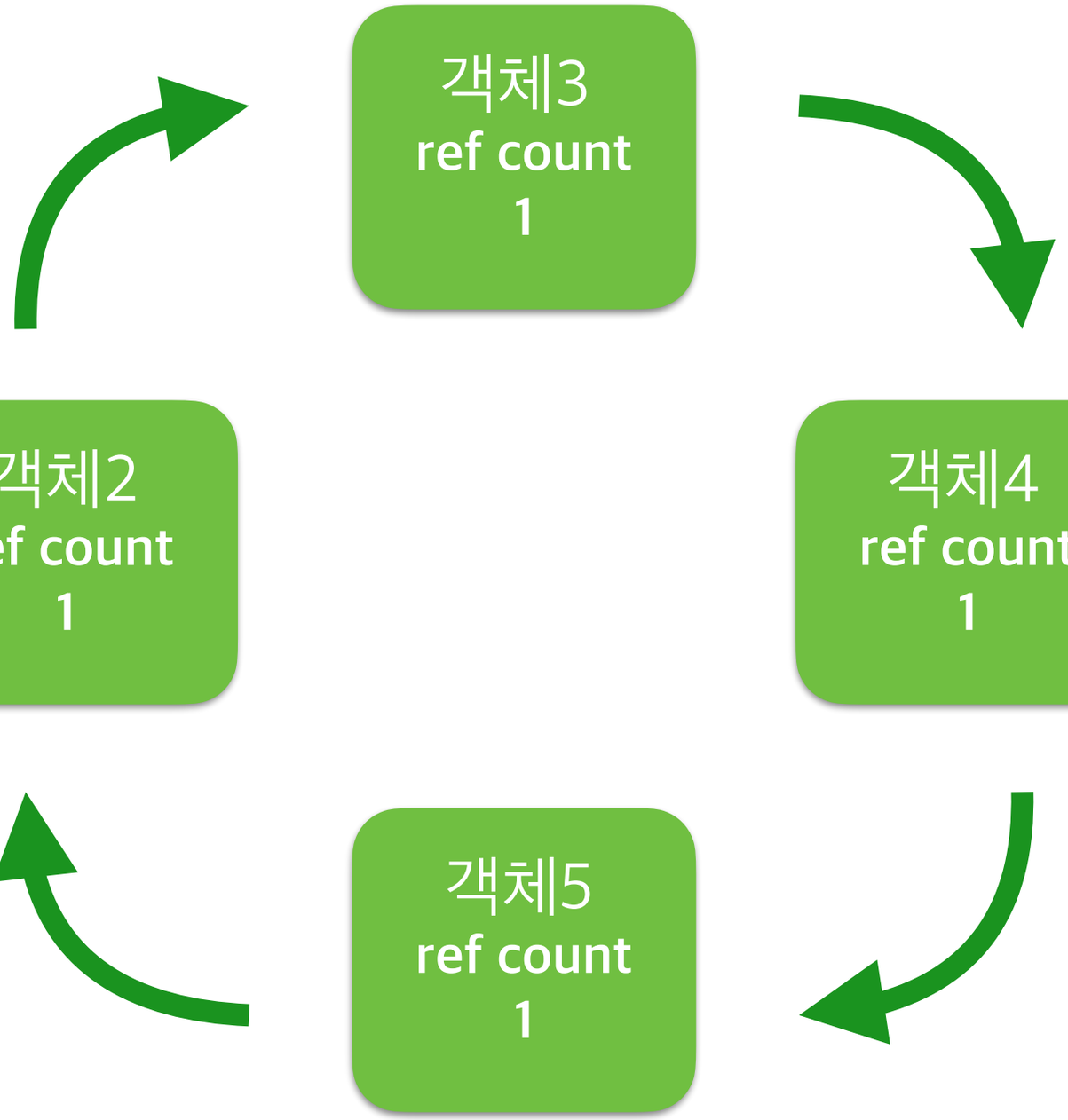

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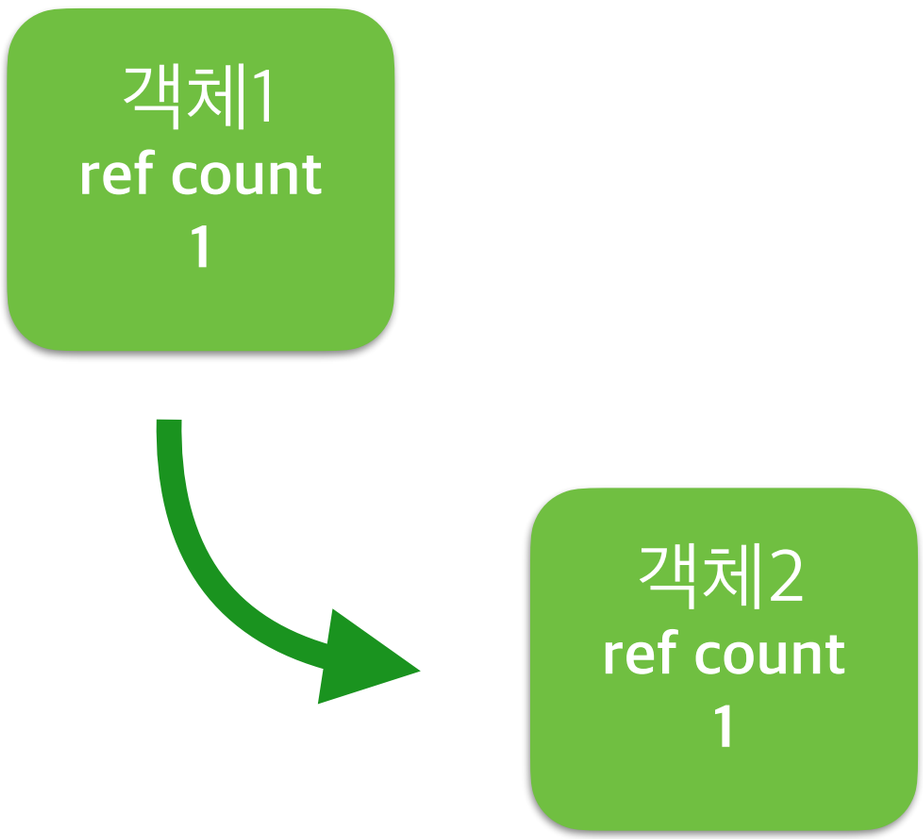

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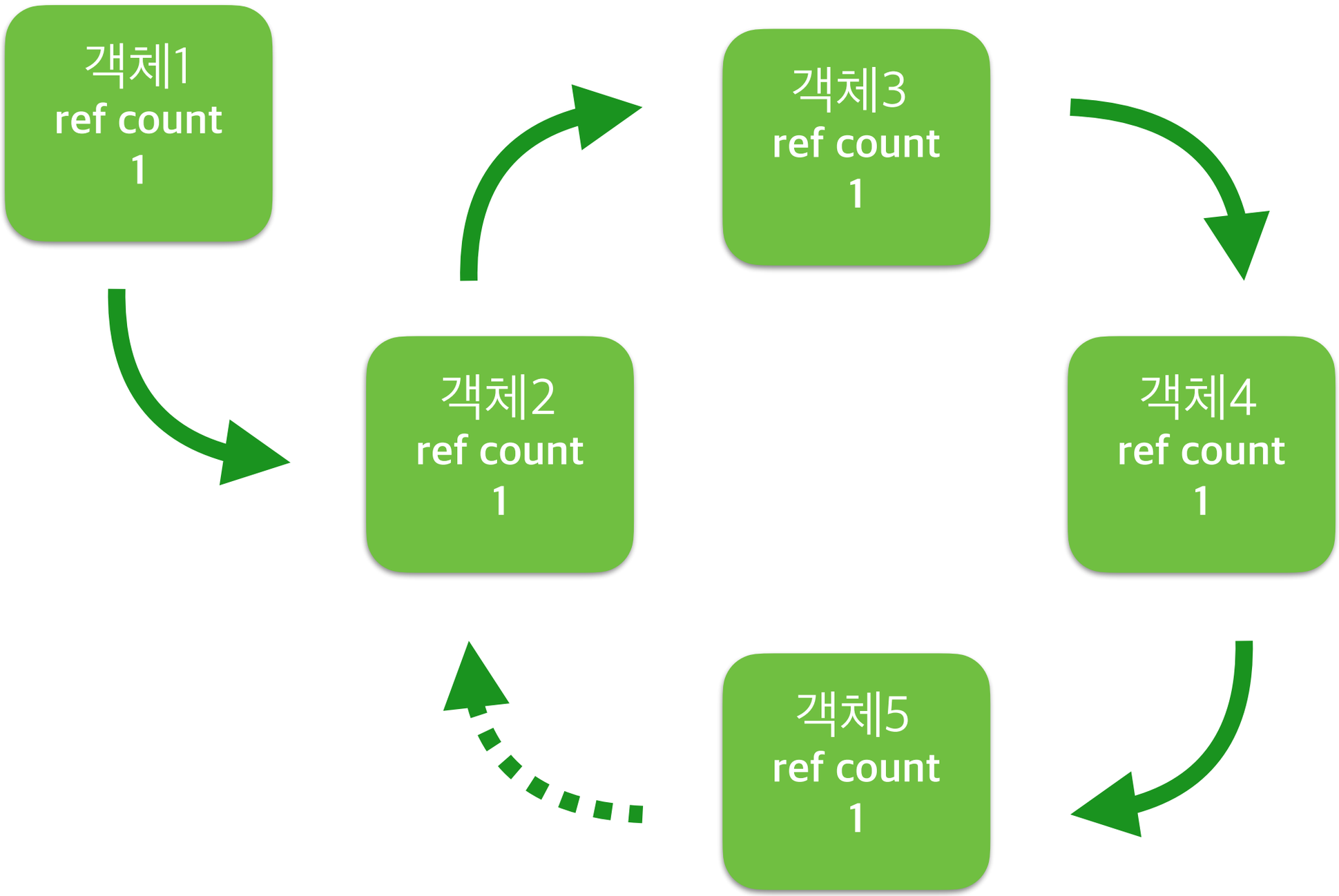

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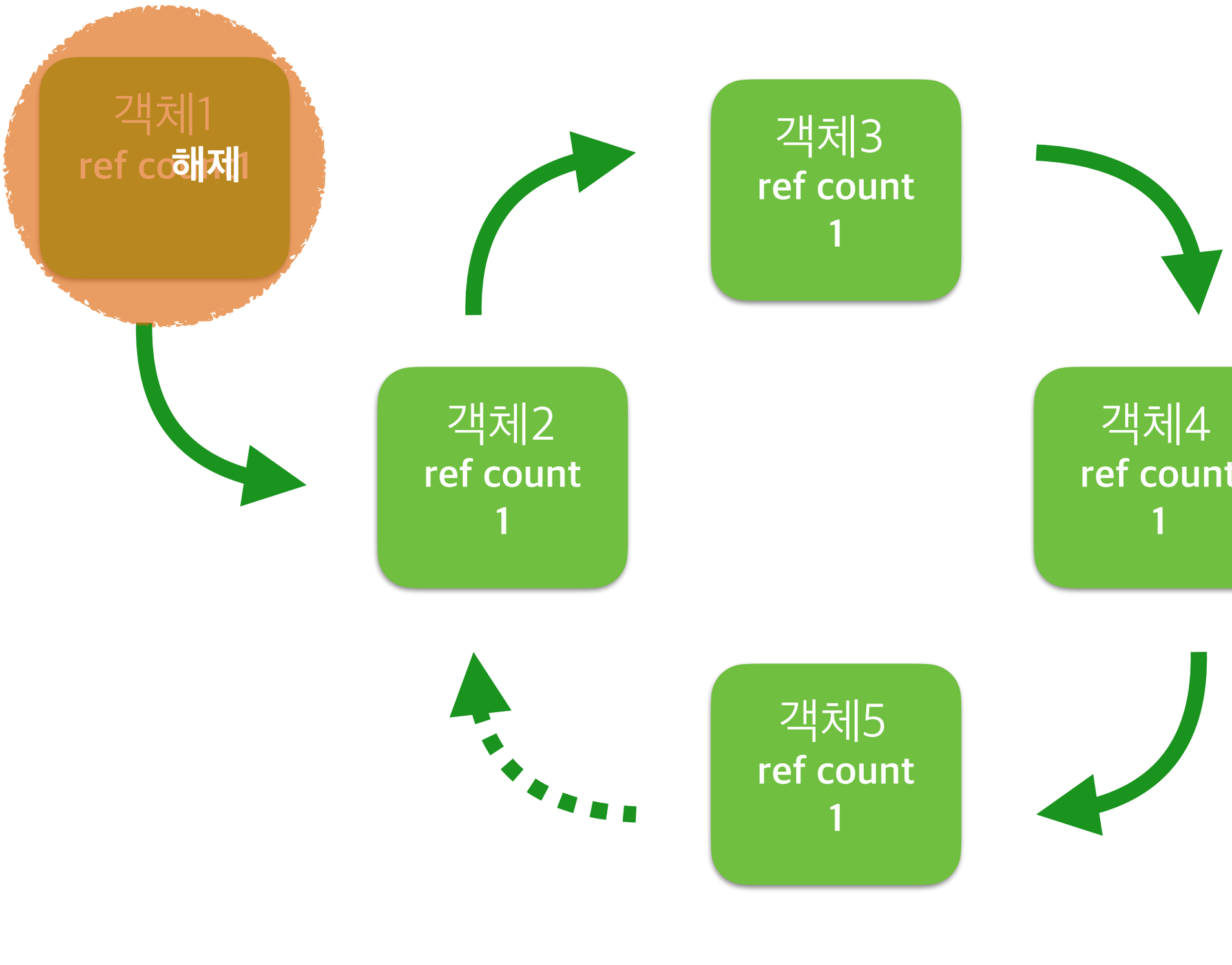

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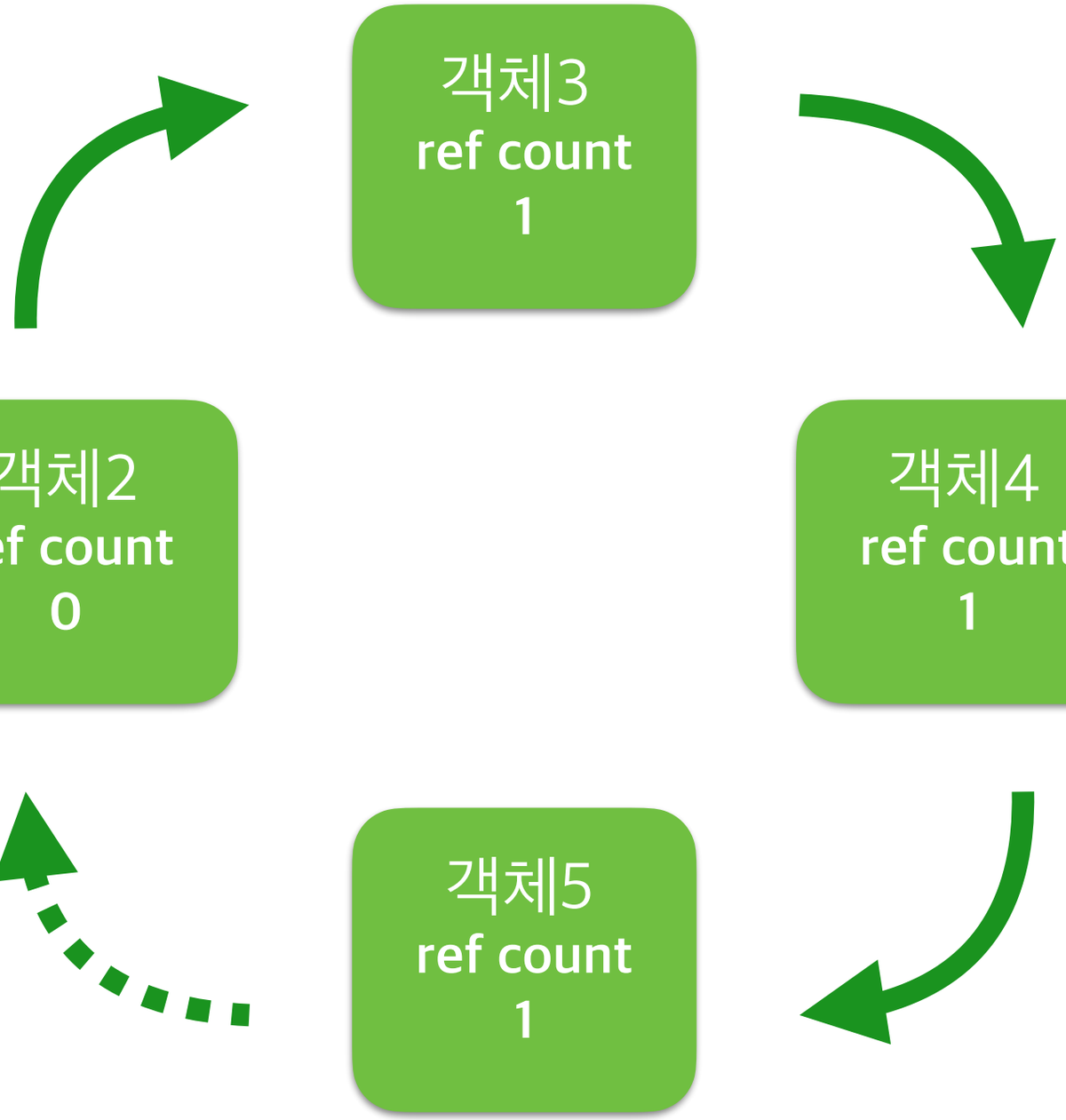

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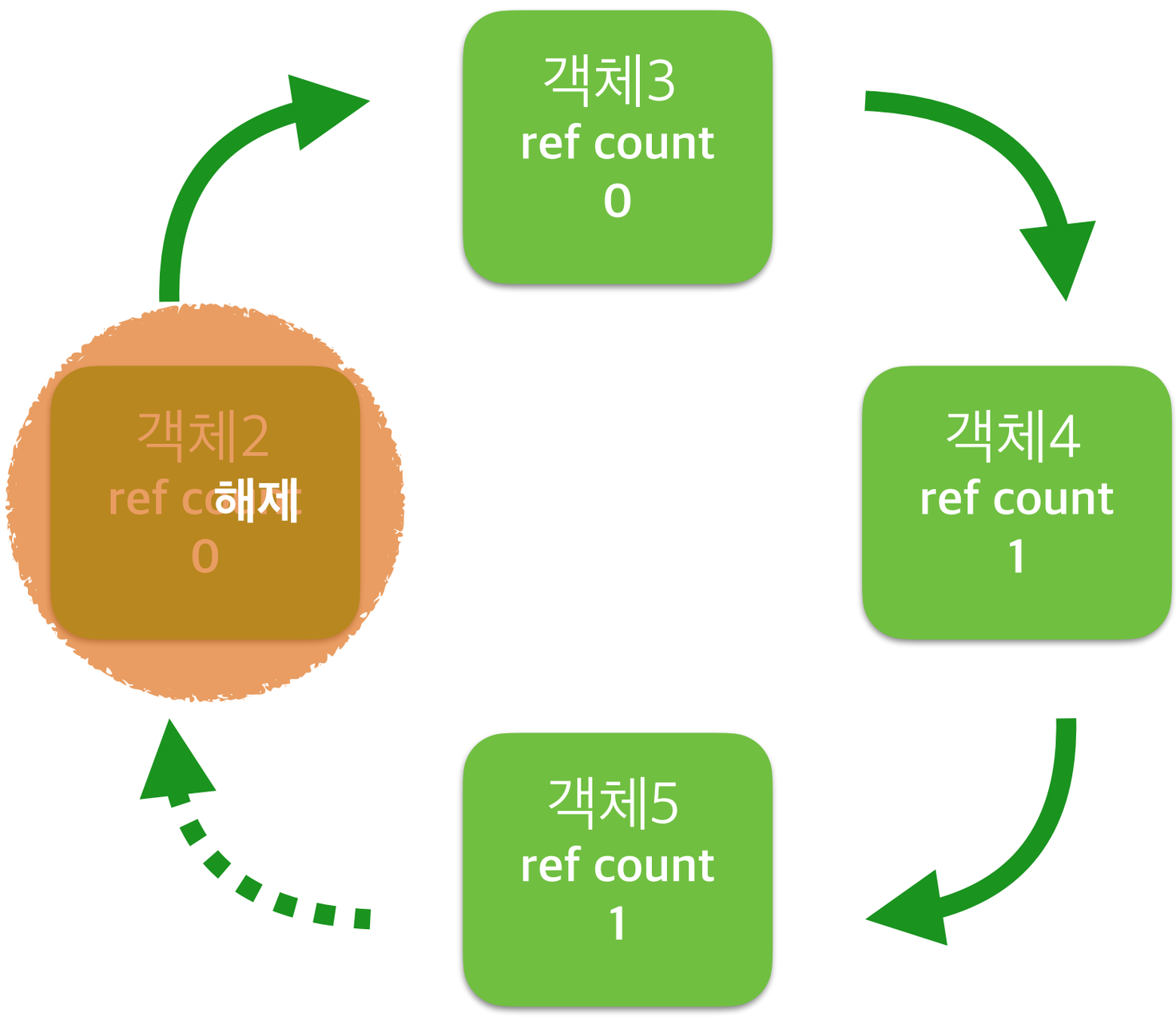

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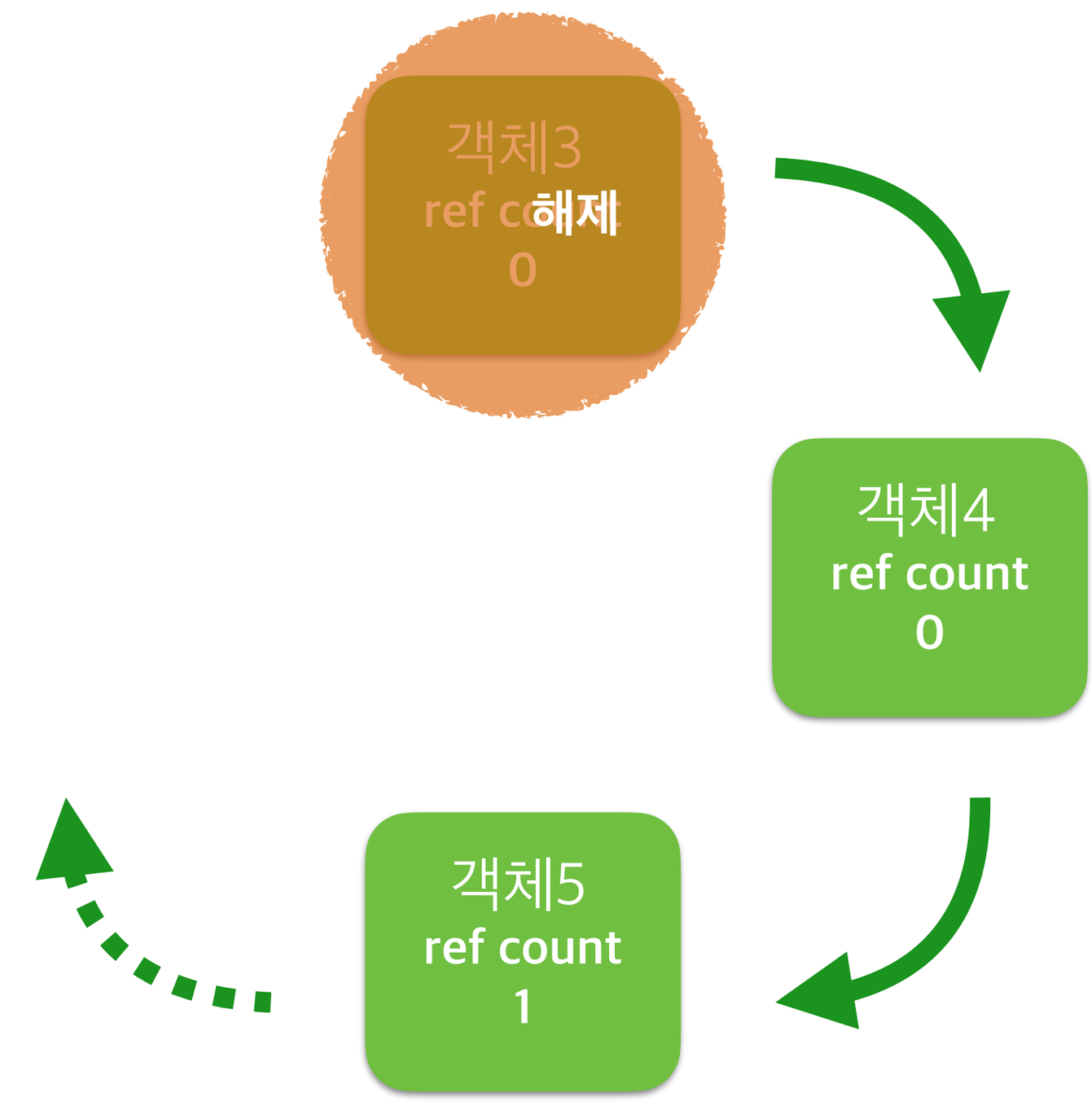

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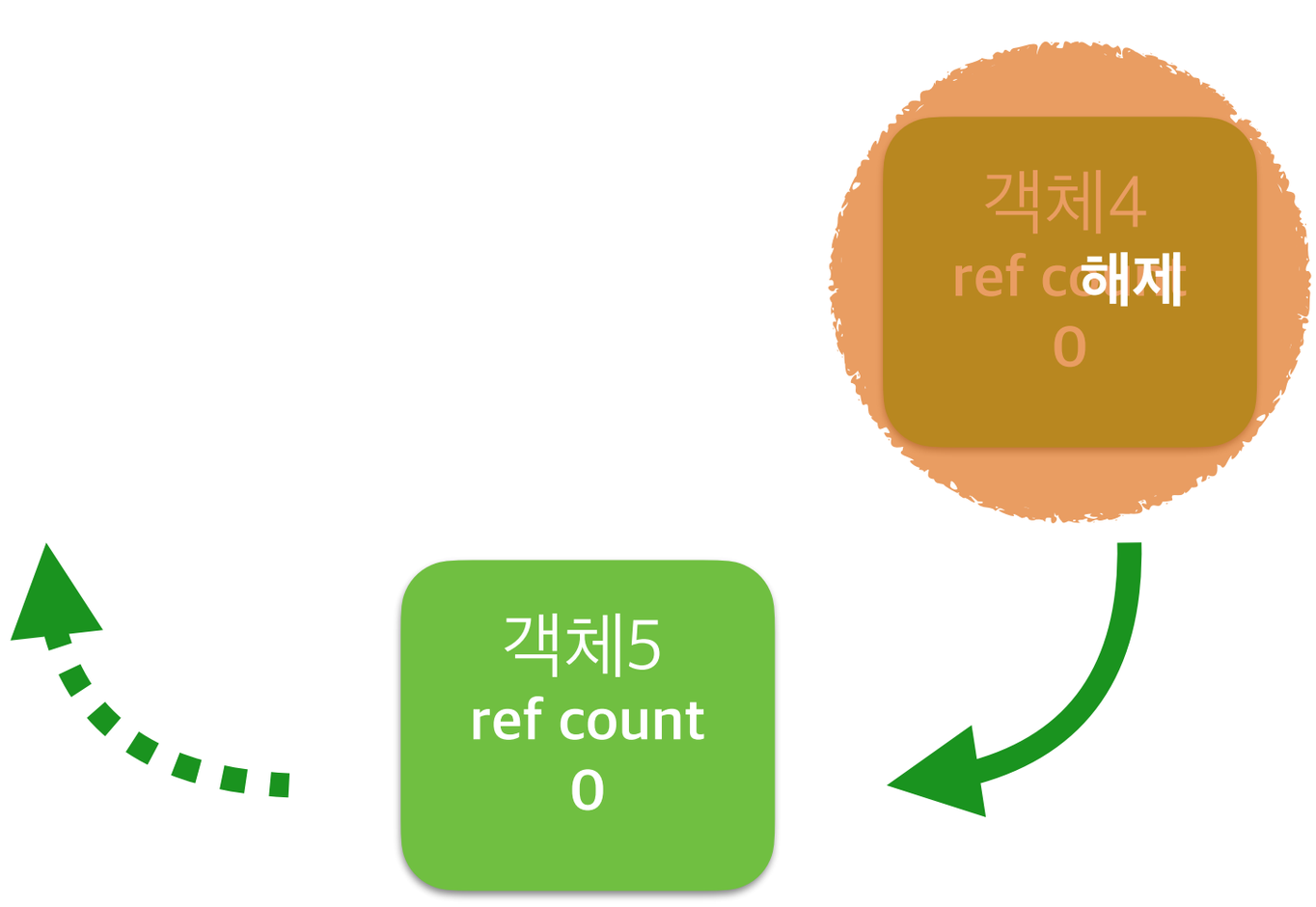

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