A Description of the RCImmix Algorithm

Reference Counting with better heap allocation

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Overview

- Introduction to automatic memory management
- Problems with existing reference counting
- The RCImmix algorithm

Manual Memory Management

Manual Memory Management

- Difficult to use
- Can cause dangling pointers
- Leads to memory leaks

Much better if the compiler/runtime can manage memory for us

Automatic Memory Management

Tracing Garbage Collector:

- Periodically pause program and follow program references
- Collect anything not referred to

Reference Counting:

- Counter keeps track of how many things are pointing to it
- When counter reaches 0, free memory

Tracing Garbage Collector

Pros:

- Is lazy about collecting
- Can detect and collect all forms of garbage
- Can compact memory to improve cache performance

Cons:

- Requires pausing the program during execution
- Needs complete control over the memory

Reference Counting

Pros:

- Doesn't normally stall[1]
-

Cons:

- Poor locality (poor cache performance)
- Slow

[1] Can still stall a bit if large chains are freed from a single decrement, ie with large linked lists

Memory Management

Listing 1: First C example

```
int main()
{
    printf("Hello World!");
    return 0;
}
```

A displayed formula:

$$\int_{-\infty}^{\infty} e^{-x^2}\,dx = \sqrt{\pi}$$

An itemized list:

- itemized item 1
- itemized item 2
- itemized item 3

Theorem

In a right triangle, the square of hypotenuse equals the sum of