

Soundness requires PL responsibility

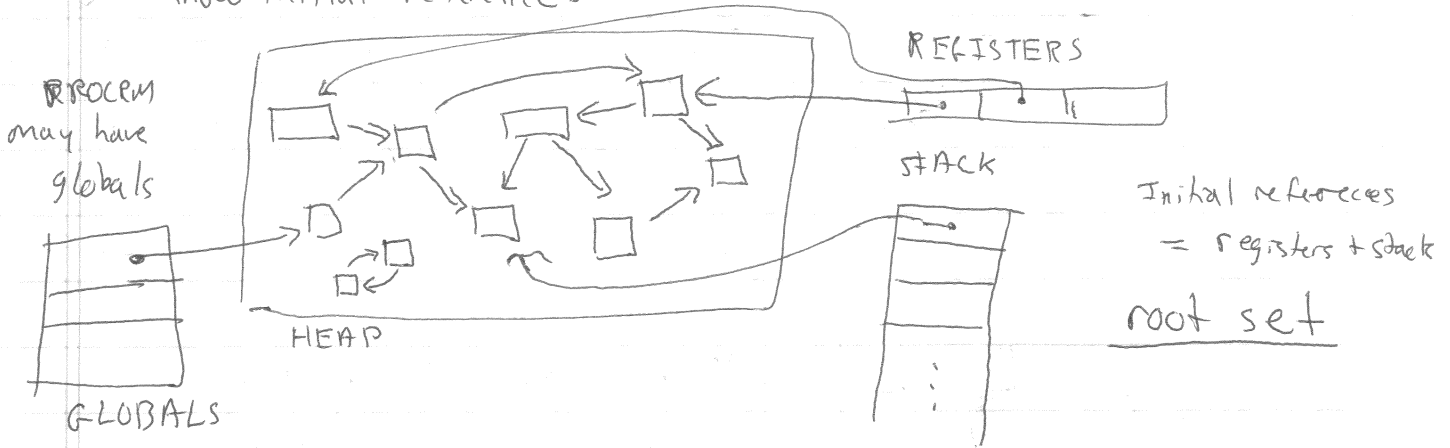
- too control of pointers (i.e. opaque)

~> this, no ptr arithmetic

- know data structure layout AT RUNTIME

↳ start objects with unique tag (i.e. 0x01 is DLL, 0x02 is free, etc)

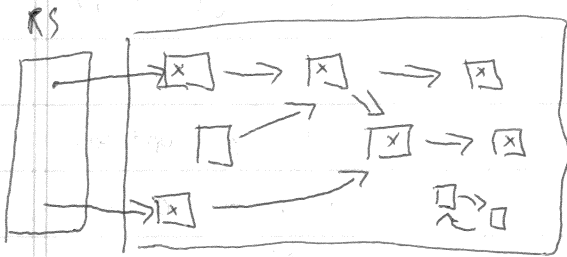
- know initial references



- Freeable = no ptr path from root set to object (Dead)

- Live = a path exists

John McCarthy made first sound mem (Mark & Sweep)



Step 1: Mark live stuff

Step 2: Look at everything and remove xs and delete unmarked

dead = garbage = collected in step 2

Memory = negligible with page-based algorithm

$$\text{Time} = O(\text{live}) + O(\text{mem}) + \lg n \cdot m/f$$

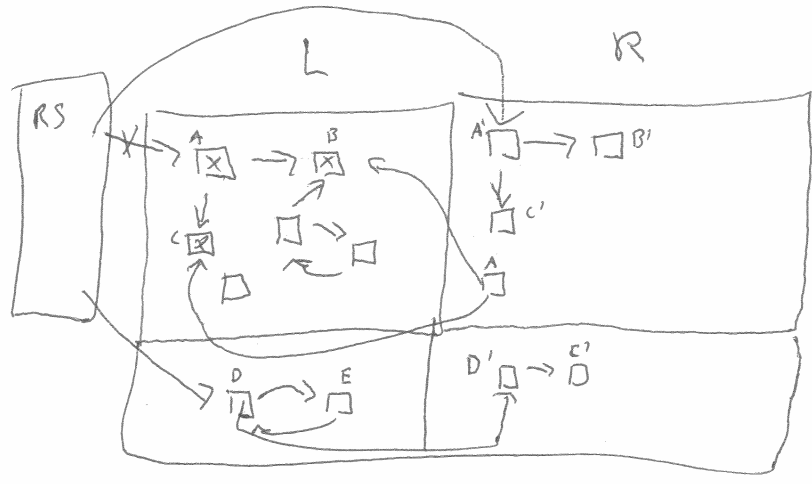
Boehm GC for C (a conservative collector because it guesses what pointers are)

cc -lgc

12-2/

Time-optimal

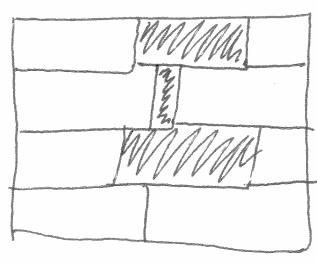
Stop & Copy



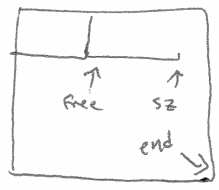
Step 1: Copy live stuff  
 Update references  
 Replace old w/ ptr to new  
 Treat R as L and L as R  
 Step 2: none!

Mem = 2x

Time = O(live) + O(1) m + O(1) f



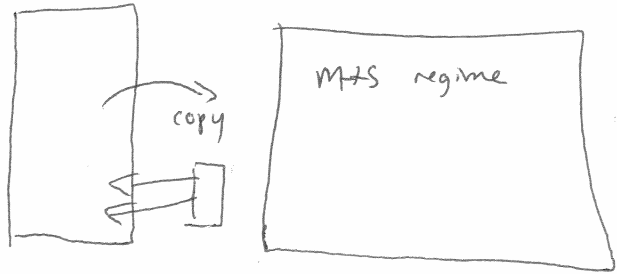
M+S, Manual, RC have fragmentation



malloc(sz)  
 if free + sz < end  
~~return~~ free += sz;  
 ret free - sz  
 O.w. gc(); malloc(sz)

Why "Stop"? M+S has a pauseless version of a real-time

Allocate a STC-like system



memory-optimal  
 time - alloc is O(1)  
 N stc is O(live)  
 memory M+S is O(mem)

Generational Collection

Radiative Decay Model

