Lecture topics:

I. Intro to GC
II. Reference counting
III. Mark-sweep GC
IV. Review

I. Intro to GC

Storage organization:

- Stack
  - (free)
- Heap
  - Records, arrays, strings
- Statics
- Code

Heap allocation example:

- `r = (i=1, n=0)``
- `s = (i=2, n=1)``
- `a = [r, s]``
- `s = null``
- `r.n = null``
- `s = (i=4, n=5)`

Garbage = heap object that will not be used in the future (e.g., `(i=2, n=1)` is unreachable)

Garbage collection (GC) = reclaim memory of garbage for reuse in later allocations

Various techniques:

- Memory management
  - Manual (e.g., `malloc/free`)
  - Garbage collection
  - Reference counting
  - Tracing GC
  - Copying GC
  - Mark-sweep GC

Tack leaves memory management unspecified

II. Reference Counting

Keep implicit "count" field in every heap object

III. Mark-sweep GC

Traverse objects from roots to find reachable
Reclaim all unreachable objects

Use mark stack (reached must scan pointers)

Mark bit in each heap object

States of object:

- Unreached: not on mark stack
- Scan: mark bit is 0
- Marked: on mark stack
- Unscanned: mark bit is 1

Example:

IV. Review

Final exam is cumulative: covers material both before and after midterm

Closed book

Usual time/place, on December 21