UNIVERSITY of WISCONSIN-MADISON
Computer Sciences Department

CS 537
Introduction to Operating Systems

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Dynamic Memory Allocation

Questions answered in this lecture:

- When is a stack appropriate? When is a heap?
- What are best-fit, first-fit, worst-fit, and buddy allocation algorithms?
- How can memory be freed (using reference counts or garbage collection)?

Motivation for Dynamic Memory

Why do processes need dynamic allocation of memory?

- Do not know amount of memory needed at compile time
- Must be pessimistic when allocate memory statically
  - Allocate enough for worst possible case
  - Storage is used inefficiently

Recursive procedures

- Do not know how many times procedure will be nested

Complex data structures: lists and trees

- `struct my_t *p=(struct my_t *)malloc(sizeof(struct my_t));`

Two types of dynamic allocation

- Stack
- Heap

Stack Organization

Definition: Memory is freed in opposite order from allocation

```
alloc(A);
alloc(B);
alloc(C);
free(C);
alloc(D);
free(B);
free(A);
```

Implementation: Pointer separates allocated and freed space

- Allocate: increment pointer
- Free: Decrement pointer