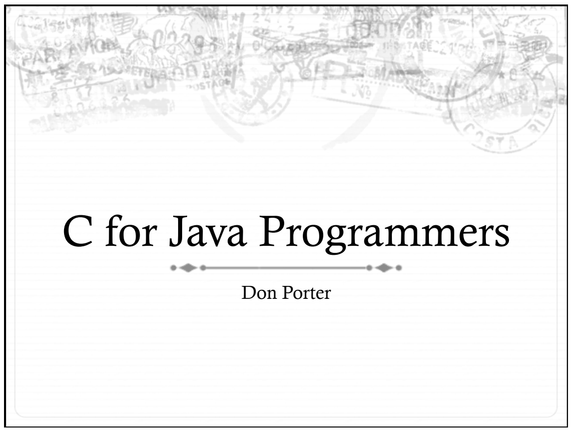
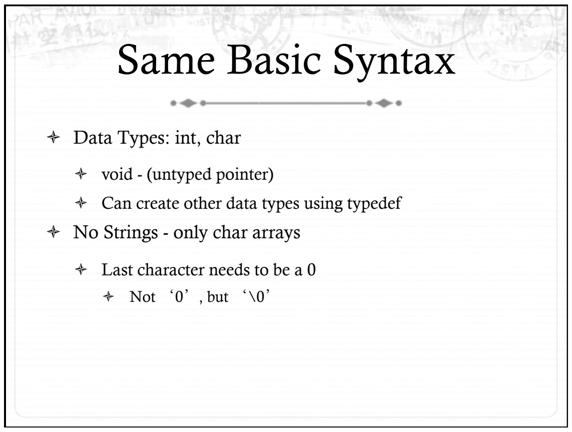


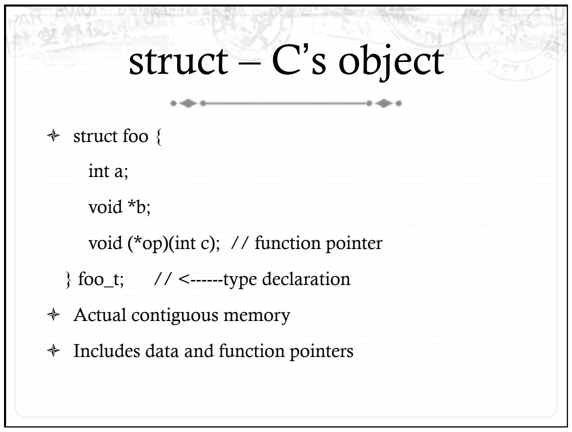
C for Java Programmers

Don Porter



Same Basic Syntax

- Data Types: int, char
  - void - (untyped pointer)
  - Can create other data types using typedef
- No Strings - only char arrays
  - Last character needs to be a 0
    - Not '0', but '\0'

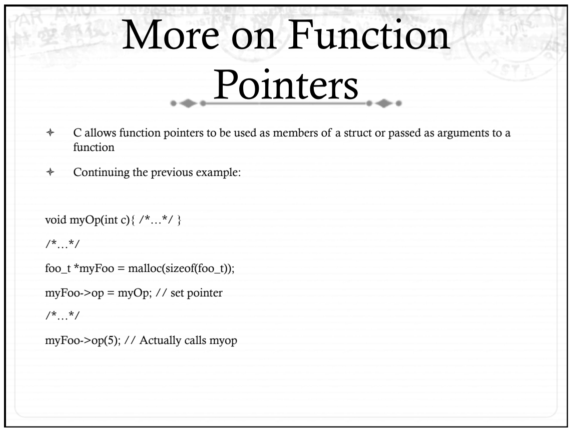


struct – C's object

- struct foo {

```
      int a;
      void *b;
      void (*op)(int c);  // function pointer
  } foo_t;      // <------type declaration
```

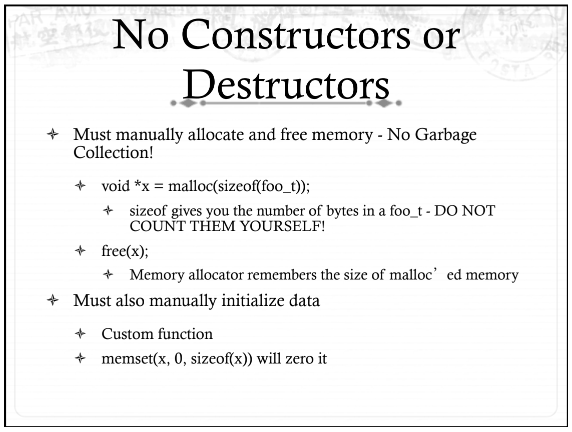
- Actual contiguous memory
- Includes data and function pointers



More on Function Pointers

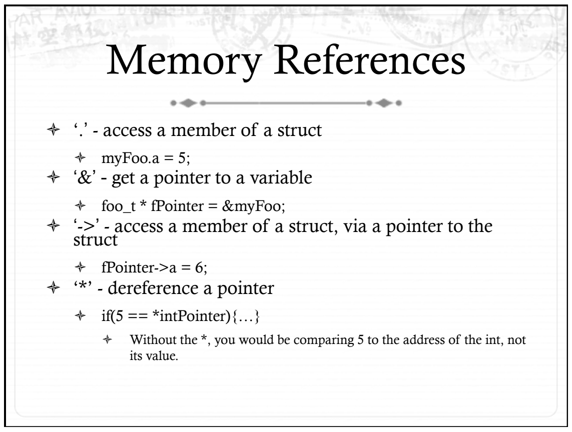
- C allows function pointers to be used as members of a struct or passed as arguments to a function
- Continuing the previous example:

```
void myOp(int c){ /*…*/ }
/*…*/
foo_t *myFoo = malloc(sizeof(foo_t));
myFoo->op = myOp; // set pointer
/*…*/
myFoo->op(5); // Actually calls myop
```



No Constructors or Destructors

- Must manually allocate and free memory - No Garbage Collection!
  - void *x = malloc(sizeof(foo_t));
    - sizeof gives you the number of bytes in a foo_t - DO NOT COUNT THEM YOURSELF!
  - free(x);
    - Memory allocator remembers the size of malloc'ed memory
- Must also manually initialize data
  - Custom function
  - memset(x, 0, sizeof(x)) will zero it



Memory References

- '.' - access a member of a struct
  - myFoo.a = 5;
- '&' - get a pointer to a variable
  - foo_t * fPointer = &myFoo;
- '->' - access a member of a struct, via a pointer to the struct
  - fPointer->a = 6;
- '*' - dereference a pointer
  - if(5 == *intPointer){…}
    - Without the *, you would be comparing 5 to the address of the int, not its value.

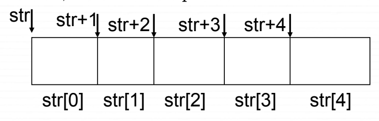
Memory References, cont.

- ‘[]’ - refer to a member of an array

  char *str = malloc(5 * sizeof(char));

  str[0] = ‘a’;

  - Note: *str = ‘a’ is equivalent
  - str++; increments the pointer such that *str == str[1]



The Chicken or The Egg?

- Many C functions (printf, malloc, etc) are implemented in libraries
- These libraries use system calls
- System calls provided by kernel
- Thus, kernel has to “reimplement” basic C libraries
  - In some cases, such as malloc, can’t use these language features until memory management is implemented

Referring to Assembly from C

- “extern” keyword imports a variable or function
- Can call a labeled code region as a function if it implements proper calling convention
  - In most cases, though, you will just inline a “call” instruction

For more help

- man pages are your friend!
  - (not a dating service)!
  - Ex: ‘man malloc’, or ‘man 3 printf’
    - Section 3 is usually where libraries live - there is a command-line utility printf as well
- Use ‘apropos *term*’ to search for man entries about *term*
- *The C Programming Language* by Brian Kernighan and Dennis Ritchie is a great reference.