

Exercise, Memory Management

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1 Administrivia

Announcements

Assignment

Read 1.5–9.

From Last Time

I/O in C.

Outline

1. I/O exercise.
2. Structures and pointers in C.

Coming Up

Memory allocation in C.

2 Exercise

Complete the exercise from last time. You *did* sketch out the code, didn't you?

3 Structures

1. Public classes without methods.
2. General structure:

```
struct <struct_identifier>
{
    <member_declaration>
    [<member_declaration> ...]
};
/* Don't forget the semicolon!!! */
```

3. Example:

```
#include <stdio.h>

/* "struct dimension" becomes a new type. */

struct dimension
{
    double length;
    double width;
    double height;
};

/* Prototypes */

void printDimension(struct dimension);

int main()
{

    struct dimension box1 = { 1.0, 1.0, 1.0 };
```

```

    struct dimension box2;

    box2.length = 2.0;
    box2.width = 4.0;
    box2.height = 6.0;

    printDimension(box2);

    return 0;
}

void printDimension(struct dimension dim)
{
    printf("Length: %g\nWidth: %g\nHeight: %g\n", dim.length,
          dim.width, dim.height);
}

```

4 Pointers

1. Pointer variables hold the address of another variable.
2. Examples similar to what we've already seen:

```

double data[10];
double *p_data;
int sum;
int *p_sum;

p_data = data;
p_data[3] = 0.0;

p_sum = &sum;
sum = 10;
printf("Sum: %d\n", *p_sum);

*p_sum = 12;    /* Dereference the pointer */;

```

3. What's going on here?

data	1000	
		0.0
...		...
p_data	1050	1000
sum	1054	12
p_sum	1058	1054

4. Pointer arithmetic

- (a) You can never add two pointers, but you can add a pointer and an integer:

```
double sum;
double data[10];
double *dp;
int i;

sum = 0.0;
for (i = 0, dp = data; i < 10; i++, dp++)
    sum += *dp;
```

Note that `dp` will be incremented by `sizeof(double)`.

- (b) `data[4]` is another way of writing `*(data + 4)`.
- (c) You can subtract two pointers:

```
int strlen(char *s)
{
    char *ptr = s;

    while (*ptr != '\0')
        ptr++;

    return ptr - s;
}
```

5. Exercise: Plain vanilla C arrays always start at an index of 0. Using what we just learned, how could you use an array and a pointer variable to create an array which began at a negative index?