

ECS30: `while`, `for`, nested loops

Dr. Rob Gysel
1/25/17

Review Session

Tonight 7pm @ Rock Hall

- Discuss sample midterm
- Write solutions
- Solutions posted to Piazza after

Overview

- Loops in C
 - `while`, `for`, `do-while`
 - Printing with `%s`
- String operations: indexing, terminating, `strlen`
- Comparing strings: `strcmp`
- More on `<ctype.h>`

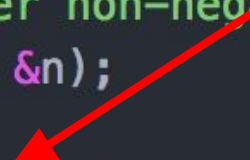
Loops

whilefactorial.c

```
while (cond) { ... statements ... }
```

1. Loop **condition**
2. Body (if **condition** true)

```
int n, result = 1;
printf("Enter non-negative n: ");
scanf("%d", &n);
int i = 1;
while (i <= n) {
    { result = result * i;
      i = i + 1;
    }
}
printf("n! Computed. %d! = %d\n", n, result);
```

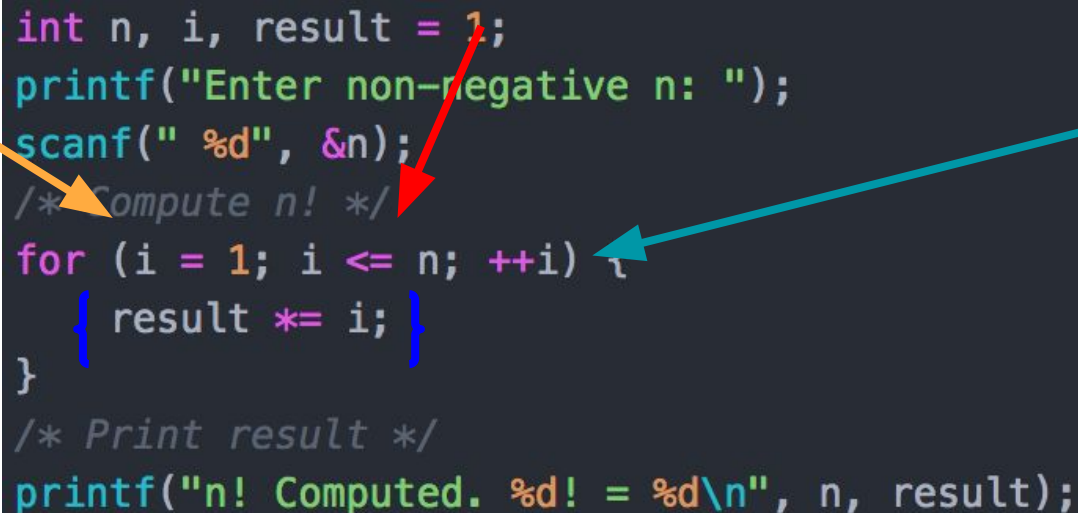


Loops

forfactorial.c

loop structure changes

1. Initialization
2. Loop condition (if true, repeat body)
3. Update (often increment or decrement)



```
int n, i, result = 1;
printf("Enter non-negative n: ");
scanf("%d", &n);
/* Compute n! */
for (i = 1; i <= n; ++i) {
    result *= i;
}
/* Print result */
printf("n! Computed. %d! = %d\n", n, result);
```

The image shows a C program to calculate a factorial. Three arrows point to specific parts of the code: an orange arrow points to the initialization 'i = 1' in the for loop; a red arrow points to the loop condition 'i <= n'; and a cyan arrow points to the update '++i'.

Prefix / Postfix operators

`i++;` and `++i;`

(Almost) equivalent to

`i = i + 1;`

Decrement: `i--;` and `--i;`

Prefix / Postfix operators

- Postfix: $i++;$
 - Increments *after* i evaluated
- Prefix: $++i;$
 - Increments *before* i evaluated

Common loop patterns

Flag-based loops

```
boolean flag = true;
while (flag) {
    ... // do something
    if (...) { // some condition
        flag = false;
    }
}
```


Common loop patterns

Nested loops

```
int i, j;
for (i = 0; i < 10; i++) {
    for (j = 0; j < 10; j++) {
        printf("(%d, %d)\n", i, j);
    }
}
```

Common loop patterns

Nested loops

- *One* nesting (i.e. `for (...) { for (...) {} }`) is common
- Two less common
- 3+: There is probably a better approach (ex: write a function!)

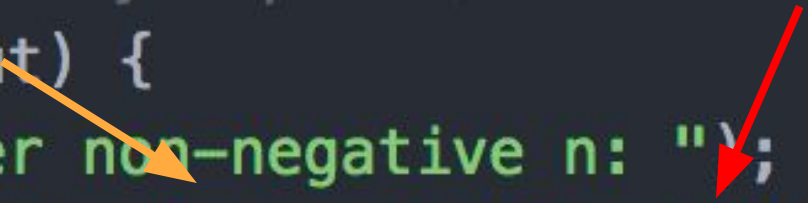
Input Validation

sanitycheckinput.c

Validating non-negative `int` input

1. `scanf` returns # of variables read successfully
2. Check that `n` is not negative

```
/* Read n and verify input */
while (!readInput) {
    printf("Enter non-negative n: ");
    if (scanf("%d", &n) == 1 && n < 0) {
        readInput = true;
    }
}
```



Input Validation

dowhilesanitycheckinput.c

Validating non-negative `int` input


`do-while` executes body *at least once*

```
/* Read n and verify input */  
do {  
    printf("Enter non-negative n: ");  
} while (scanf("%d", &n) != 1 || n < 0);
```

Flushing input (`stdin`)

User input sent to *standard input* (`stdin`)

```
campus-097-225:Lecture Programs RobsMacAir$ ./sanitycheckinput  
Enter non-negative n: f
```



Q: What happens if non-`int` entered?

A: `scanf` looks for `int`, sees non-digit char `f`, stops. Leaves `f` in *input buffer* (to be read later)

Flushing input (`stdin`)

Causes infinite loop on non-`int` input:

```
/* Read n and verify input */
while (!readInput) {
    printf("Enter non-negative n: ");
    if (scanf("%d", &n) == 1 && n < 0) {
        readInput = true;
    }
}
```

1. Body of `while`: try to read `int` with `scanf`
2. Fail on non-`int` input, leave input in buffer
3. Condition `false`, so go to 1

Flushing input (`stdin`)

```
campus-097-225:Lecture Programs RobsMacAir$ ./sanitycheckinput
Enter non-negative n: f
```

```
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Flushing input (`stdin`)

Causes infinite loop on non-`int` input:

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/* Read n and verify input */
while (!readInput) {
    printf("Enter non-negative n: ");
    if (scanf("%d", &n) == 1 && n < 0) {
        readInput = true;
    }
}
```

1. Body of `while`: try to read `int` with `scanf`
2. Fail on non-`int` input, leave input in buffer
3. Condition `false`, so go to 1

Flushing input (`stdin`)

How to flush `stdin`:

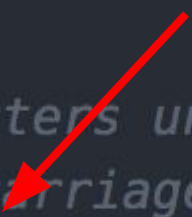
```
// Flush stdin buffer  
void flushStdin() {  
    char c;  
    // Skip all characters until end-of-file marker  
    // or new line / carriage return  
    while ( (c = getchar()) != EOF &&  
            c != '\n' &&  
            c != '\r' ) {};  
}
```

Flushing input (`stdin`)

How to flush `stdin`:

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```

Read chars in
input buffer




Flushing input (`stdin`)

How to flush `stdin`:

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    while ( (c = getchar()) != EOF &&  
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            c != '\r' ) {};  
}
```

Stops if input ends



Flushing input (`stdin`)

How to flush `stdin`:

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// Flush stdin buffer
void flushStdin() {
    char c;
    // Skip all characters until end-of-file marker
    // or new line / carriage return
    while ( (c = getchar()) != EOF &&
            c != '\n' &&
            c != '\r' ) {}
}
```

← Last char is user hitting <enter>