IS12 - Introduction to Programming
Lecture 16: For and Switch

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Complex Conditions: NOT

■ NOT operation: ! ex

  – evaluated to 1 (true) if ex equals to 0 (false is C terms)

  – otherwise evaluated to 0

```
c = 4;
!c ⇨ 0
!(c > 3) ⇨ 0
!(c < 3) ⇨ 1
!(c > 3 || c < 5) ⇨ 0
```

Example: Counting non-digits

```c
#include <stdio.h>

void main() {

    char ch;
    int nondig = 0;

    /* Accumulating counters in the loop */
    while ((ch = getchar()) != EOF)
        if (! (ch >= '0' && ch <= '9'))
                nondig++;

    /* Printing results */
    printf("Numbers of non-digits is %d:\n", nondig);
}
```

Example: ABC Counting

```c
#include <stdio.h>
void main() {
    char ch;
    int a = 0, b = 0, c = 0;

    /* Accumulating counters in the loop */
    while ((ch = getchar()) != EOF)
        if (ch == 'a' || ch == 'A')
                a++;
        else if (ch == 'b' || ch == 'B')
                b++;
        else if (ch == 'c' || ch == 'C')
                c++;

    /* Printing results */
    printf("\nNumbers of characters:\n\n");
    printf("a %d; b %d; c %d; \n", a, b, c);
}
```

Example: Word Counting

```c
#include <stdio.h>
#define IN 1 /* inside a word */
#define OUT 2 /* outside a word */
void main () {
    int c, nl, nw, nc, state;

    state = OUT;
    nl = nw = nc = 0;
    while ((c = getchar()) != EOF) {
        ++nc; /* symbol counting */
        if (c == '\n') ++nl; /* line counting */
        if (c == ' ' || c == '\n' || c == '\t') /* word counting */
                state = OUT;
        else if (state == OUT) {
                state = IN; /* count a word when turning from OUT to IN */
                ++nw;
        }
    }
    printf("%d %d %d\n", nl, nw, nc);
}
```

switch: multiple selection

```
switch (expression) {
    case exp1:
        statement11; statement12; … break;
    case exp2:
        statement21; statement22; … break;
    case exp3:
        statement31; statement32; … break;
    …
    default:
        statementN1; statementN2; … break;
}
```

Example: ABC Counting

```c
/* Accumulating counters in the loop */
while ((ch = getchar()) != EOF)
    switch (ch) {
        case 'a':
        case 'A':
                a++; break;
        case 'b':
        case 'B':
                b++; break;
        case 'c':
        case 'C':
                c++; break;
    }
```

`switch` vs. `else-if`

- Switch is a natural construct for multiple selection in the case of integer expression, else-if is more general
- Switch has a more efficient implementation
- Similar constructs exist in other languages
- In C language switch has to be used with break since execution is continuous

For Loop

```
for (ex1; ex2; ex3)
   ex4;
```
- Is simply:
```
ex1;
while (ex2) {
   ex4;
   ex3;
}
```

Example: Average Line Length

```c
#include <stdio.h>

void main () {
    int c, nl = 0;
    long nc;

    nc = 0;
    while((c = getchar()) != EOF) {
        if(c == '\n')
                ++nl;
        ++nc;
    }
    if(nl)
        printf("Average line length: %.2f\n", nc / (float) nl);
}
```

Example: Average Line Length 2

```c
#include <stdio.h>

void main () {
    int c, nl = 0;
    long nc;

    for (nc = 0; (c = getchar()) != EOF; ++nc)
        if(c == '\n')
                ++nl;

    if(nl)
        printf("Average line length: %.2f\n", nc / (float) nl);
}
```

While and for loops

■ While loop

```c
nc = 0;
while((c = getchar()) != EOF) {
    if(c == '\n')
            ++nl;
    ++nc;
}

for (nc = 0; (c = getchar()) != EOF; ++nc)
    if(c == '\n')
            ++nl;
```

■ Equivalent for loop

Example: Conversion Table F2C

```
void main () {
    float fahr, celsius;
    int lower, upper, step;

    lower = 0;    /* lower limit of temperature table */
    upper = 300; /* upper limit */
    step = 20;    /* step size */

    fahr = lower;
    while (fahr <= upper) {
        celsius = (5.0 / 9.0) * (fahr - 32.0);
        printf ("%3.0f %6.1f\n", fahr, celsius);
        fahr = fahr + step;
    }
}
```

Example: Conversion Table F2C

```
#include <stdio.h>

void main () {
    float fahr, celsius;
    int lower, upper, step;

    lower = 0;    /* lower limit of temperature table */
    upper = 300; /* upper limit */
    step = 20;    /* step size */

    for(fahr = lower; fahr <= upper; fahr = fahr + step) {
        celsius = (5.0 / 9.0) * (fahr - 32.0);
        printf ("%3.0f %6.1f\n", fahr, celsius);
    }
}
```

For vs. While

- For loop could be considered as a compressed form of while
- For is convenient for tasks like counting and table processing
- For is very useful for *array* processing
- All information about loop control is collected in the header of the loop

Before Next Lecture:

- Do reading assignment
  - Perry: Chapter 15 and Chapter 17
- Run Classroom Examples
- Use KnowledgeTree
- Exercise: word counter with for
- Exercise: counting digits ('0', '1', ..., '9') in the text read from the standard input using switch and for loop