I/O Functions & Securities

For copyright and license information,
http://class.icc.skku.ac.kr/~min/program/license.html

Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

I /O Functions

- **File Open/Close** - fopen, fclose
- **Formatted I/O**
  - scanf / fscanf / sscanf
  - printf / fprintf / sprintf / snprintf
- **The other text I/O functions**
  - fgets, fputs, fgetc, fputc
- **Binary I/O functions**
  - fread, fwrite

Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

Check User's Inputs

- **Why ?**
  - User gives inputs that developers may not expect, and should give proper error messages if user enters wrong inputs.
  - For security
- **Input File** as well as keyboard, mouse, touches

Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

Example 1

```
int  math = -1;
while (math < 0 || math > 99) {
        printf("Enter math grade : ");
        scanf ("%d", &math);
}
```

- User enters "math<r>", where <r> means a return key input
- What happens ?

Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

Example 2

```
char  name[10];
char  welcome[ ] = “Hello,”;
printf(“Enter name : “);
scanf(“%s”, name);
printf(“%s %s\n”, welcome, name);
```

- User enters “Johann Sebastian Bach<r>”, what happens?

Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

Give Proper Error Messages

- Give proper error messages for user's inputs which are wrong for the program to run
  - Check return value(s) of I/O functions
  - Check values which user enters
- Do not use scanf for inputs
  - Use fgets() instead, and then
  - Use sscanf() to separate inputs

Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

Example 3

```
int  math = -1;
while (math < 0) {
        char line[100];
        printf("Enter math grade : ");
        if ( ! fgets(line, 100, stdin)) {
                printf("EOF found.\n");  return 100;
        }
        int num = sscanf (line, "%d", &math);
        if (num != 1 || math < 0 || math > 99)
                continue;   // need error message
}
```


Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

Buffer Overflow

- Overruns the buffer's boundary and overwrites adjacent memory locations.
- Refer to Example 2, and below.

```
int  array[5], *another;
another = (int *)malloc(3*sizeof(int));
array[5] = 20;  another[0] = 4;
```

- Wrong operations of program
- Security problem

Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

Example 4

```
char  name[10];
char  welcome[ ] = “Hello”;
printf(“Enter name : “);
fgets(name, 10, stdin);
printf(“%s %s\n”, welcome, name);
```

- or you may use

```
scanf(“%9s”, name);   // 1 for enter key
```


Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

Never Use …

- Never use “gets(), atoi(), atol(), sprintf()”

- Use fgets() for gets()
- Use strtol() for atoi(), atol()
- Use snprintf() for sprintf()

Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

Always Check Return Values

- For all I/O functions in page 2, always check return values
- 2 exceptions: Nothing to do when error occurs
  - printf()
  - fclose()

Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

From Today, For Every Homeworks …

- Check return values of I/O functions, and give proper error messages when there is error(s)
- You'll get loss of your grades if you forget to do so.
- For details on what are returned by each functions, refer to the following URL

  http://class.icc.skku.ac.kr/~min/<class>/download/man/

Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

strtol()

- Convert a number string to long integer
- Returns converted long integer

```
char  *endptr, *str = “234abc”;
int  val = strtol(str, &endptr, 10);
if (endptr == str) {
        fprintf(stderr, "No digits were found\n"); return ERR;
}
printf(“converted value = %ld\n", val);
if (*endptr != '\0')
        printf(“More characters after number: %s\n", endptr);
```


Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.

Happy Coding !!

Ada Lovelace , Countess of Lovelace and daughter of Byron, also known for her work as the 1st computer programmer.

This picture is courtesy of Alfred Edward Chalon and in public domain.

Copyright (c) 2003-2017 by Hyoung Bok Min and Sungkyunkwan University, All rights reserved.