CSC209 Week 5 Notes

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Files in C 1 of 5

- Opening file
  - **Syntax:** *fopen(const char *filename, const char *mode)
  - the import file should be in the same folder as 'a.out' (default)
  - Mode Strings
    1. *r* - File opened for reading
    2. *w* - File opened for writing
    3. *a* - File opened for appending

```c
#include <stdio.h>

int main() {
    FILE *sample_file;

    sample_file = fopen("example_sources/sample.txt", "r");
    if (sample_file == NULL) {
        fprintf(stderr, "Error opening file \n");
        return 1;
    }

    ...

    return 0;
}

```

- Closing file
  - **Syntax:** fclose(FILE *filename)
  - returns 0 if close successful

```c
#include <stdio.h>

int main() {
```

```
        FILE *sample_file;

        ...

        if (fclose(sample_file) != 0) {
            fprintf(stderr, "fclose failed\n");
            return 1;
        }

        return 0;
    }

```

Files in C 2 of 5

- Reading from Files
  - **Syntax:** char *fgets(char *s, int n, FILE *stream)
  - Reads data line by line
    1. *char *s* is a pointer to memory where text can be stored
       - Note new var can be created here, like for loop (i.e. for(i=0; i ¡ 1; i++)).
       - On success, fgets returns *s*
       - On failure, fgets returns NULL
    2. *int n* is the maximum upper number of characters fgets allowed to put in *s*

```
#include <stdio.h>

#define LINE_LENGTH 80

int main() {
    FILE *sample_file;
    int error;
    char line[LINE_LENGTH + 1];

    sample_file = fopen("example_sources/sample.txt", "r");

    while (fgets(line, LINE_LENGTH + 1, sample_file) != NULL) {
        printf("%s", line);
    }

    ...
    return 0;
}

```

- Reading from Input

  - **Syntax:** fgets(line, LINE_LENGTH + 1, stdin)
  - Notice *stdin* is the standard input, like input in Python

```c
#include <stdio.h>

#define LINE_LENGTH 80

int main() {
    char line[LINE_LENGTH + 1];

    while (fgets(line, LINE_LENGTH + 1, stdin) != NULL) {
        printf("%s", line);
    }

    return 0;
}

```

Files in C 3 of 5

- The scanf function
  - returns successfully read items
  - number of read items depends on format
  - **Syntax:** int fscanf(FILE *stream, const char *format, type *s, type *n)

```c
#include <stdio.h>

#define LINE_LENGTH 80

int main() {
    FILE *sample_file;
    int error, score, total;

    sample_file = fopen("example_sources/sample.txt", "r");
    if (sample_file == NULL) {
        perror("Error opening file\n");
        return 1;
    }

    while (fscanf(sample_file, "%d %d", &score, &total) == 2) { // <- ==2 means each fscan must return 2 values, one for each col.
        printf("Score: %d, Total: %d.\n", score, total);
    }

    error = fclose(sample_file);
    if (error != 0) {
```

```
21              perror("fclose failed on input file\n");
22              return 1;
23          }
24
25          return 0;
26      }
27
```

Files in C 4 of 5

- Writing to Files
  - **Syntax:** output_file = fopen(const char *filename, "w")
    - *w* overwrites existing file
    - *a* appends output to the end of file

```
1       #include <stdio.h>
2
3       int main() {
4           FILE *output_file;
5           int error;
6           int total = 50;
7           float small_number = 0.125;
8
9           output_file = fopen("example_sources/output.txt", "w")
    ;
10          if (output_file == NULL) {
11              perror("Error opening file\n");
12              return 1;
13          }
14
15          fprintf(output_file, "The first line in the file\n");
16          fprintf(output_file, "The integer is %d\n", total);
17          fprintf(output_file, "The small float is %f\n",
    small_number);
18
19          ...
20
21          return 0;
22      }
23
```

  - NOTE: the output stream is first stored in memory controlled by OS before to disk

* OS periodically writes content from memory to disk
* Abnormal computer shutdown → some data may be lost

```
1
2
```

Files in C 5 of 5

- Bringing Everything Together

```c
#include <stdio.h>

int main() {
    FILE *sample_file, *output_file;
    int error_open, error_closed, score;
    int total = 50;

    sample_file = fopen("example_sources/sample.txt", "r");
    if (sample_file == NULL) {
        fprintf(stderr, "Error opening file \n");
        return 1;
    }

    output_file = fopen("example_sources/output.txt", "w");
    if (output_file == NULL) {
        perror("Error opening file\n");
        return 1;
    }

    while (fscanf(sample_file, "%d %d", &score, &total) == 2) {
        printf("Score: %d\n", score);
        fprintf(output_file, "Score: %d\n", score);
    }

    error_open = fclose(sample_file);
    if (error_open != 0) {
        perror("fclose failed\n");
        return 1;
    }

    error_closed = fclose(output_file);
```

```
32          if (error_closed != 0) {
33              perror("fclose failed\n");
34              return 1;
35          }
36
37          return 0;
38      }
39
```

Listing 1: files_example_5.c

Strings in C 1 of 6

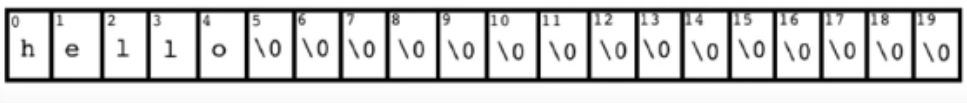
- Introduction to Strings
  - String is an array of chars with '\0' at the end
    - i.e. 'hello' = ['h','e','l','l','o','\0']
    - without '\0', undesired output is included, i.e. hello?[BT

Strings in C 2 of 6

- Initializing Strings and String Literals
  - There are two ways
    1. Using array

```
1       #include <stdio.h>
2
3       int main() {
4           char text[20] = {'h','e','l','l','o','\0'};
5
6           printf("%s\n", text);
7           return 0;
8       }
9
```

    - The following is how array looks like after initialization



    2. Using array of chosen size and double quoted string

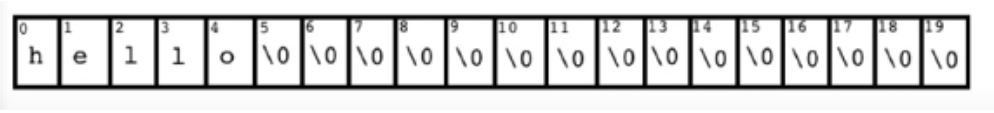
```c
#include <stdio.h>

int main() {
    char text[20] = "hello";

    printf("%s\n", text);
    return 0;
}

```

* The following is how array looks like after initialization



* Note: char text[5] = "hello"; causes error, since '\0' is not included.

3. Using array of unchosen size and double quoted string

```c
#include <stdio.h>

int main() {
    char text[] = "hello";

    printf("%s\n", text);
    return 0;
}

```

* Here, the size of string is just enough for characters plus '\0'.

4. Using pointers

```c
#include <stdio.h>

int main() {
    char *text = "hello";

    printf("%s\n", text);
    return 0;
}

```

Strings in C 2 of 6

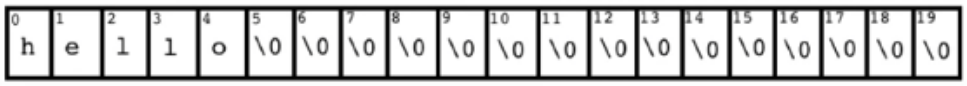
- Initializing Strings and String Literals
  - There are two ways
    1. Using array

```c
#include <stdio.h>

int main() {
    char text[20] = {'h','e','l','l','o','\0'};

    printf("%s\n", text);
    return 0;
}
```

* The following is how array looks like after initialization



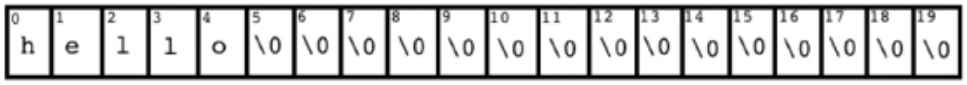
2. Using array of chosen size and double quoted string

```c
#include <stdio.h>

int main() {
    char text[20] = "hello";

    printf("%s\n", text);
    return 0;
}
```

* The following is how array looks like after initialization



* Note: char text[5] = "hello"; causes error, since '\0' is not included.

3. Using array of unchosen size and double quoted string

```c
#include <stdio.h>

int main() {
    char text[] = "hello";

    printf("%s\n", text);
    return 0;
}
```

* Here, the size of string is just enough for characters plus '\0'.

4. Using pointers

```c
#include <stdio.h>

int main() {
    char *text = "hello";

    printf("%s\n", text);
```

```
7           return 0;
8       }
9
```

Strings in C 3 of 6

- Size and Length
  - strlen
    - **Syntax:** size_t strlen(const char *s)
    - is from c-string library, i.e. ‘<string.h >‘
    - is the recommended way to determine the length of string

```
1   #include <stdio.h>
2   #include <string.h>
3
4   int main() {
5       char weekday[10] = "Monday";
6       printf("Length of string: %lu\n", strlen(weekday)); // <-
    Returns 6
7       ...
8       return 0;
9   }
10
```

Listing 2: strings_example_3.c

  - sizeof
    - returns total size of array
    - not a good way to measure the length of string

Strings in C 4 of 6

- Copying Strings
  - strncpy
    - **Syntax:** char *strncpy(char *s1, const char *s2, int n);
    - **strncpy:** is a function from c-string library
    - **s1:** is destination
    - **s2:** is source
    - **n** is max number of characters to be copied from source

* n is determined based on the string of lesser size

```c
#include <stdio.h>
#include <string.h>

int main() {
    char s1[5];
    char s2[32] = "University of";
    strncpy(s1,s2, sizeof(s1));
    s1[4] = '\0';
    printf("%s\n", s1);
    printf("%s\n", s2);
    return 0;
}

```

Listing 3: strings_example_4.c

  - Note: '\0' is added at the end of s1 to ensure the copied string is safe.

– strcpy

* Don't do it.
* This is not safe.

Strings in C 5 of 6

- Concatenating Strings

– strncat

* **Syntax:** char *strncat(char *s1, const char *s2, int n);
  - **s1:** is the destination
  - **s2:** is the source
  - **n:** is the max number of characters without null terminator to be copied from *s2* to *s1*.

    This is usually *sizeof(s1)*

```c
#include <stdio.h>
#include <string.h>

int main() {
    char s1[30];
    char s2[14] = "University of";
    char s3[15] = "C Programming";

    strncpy(s1,s2, sizeof(s1));
    s1[sizeof(s1)-1] = '\0';
```

```
11          strncat(s1, s3, sizeof(s1) - strlen(s1) -1); // -1 is
    for \0.
12          printf("%s\n", s1);
13          printf("%s\n", s2);
14          printf("%s\n", s1);
15          return 0;
16      }
17
```

Listing 4: strings_example_5.c

- Note: *sizeof(s1) - strlen(s1) -1* is the remaining space in *s1* excluding the null character.

– strcat

* This is not safe.
* Don't use it. No No!!
* If use it, then bad Moe, bad!!

Strings in C 6 of 6

- Searching with strings

– strchr

* **Syntax:** char *strchr(const char *s, int c)
  - **s:** is the string to search in
  - **c:** is the character to search for

```
1   #include <stdio.h>
2   #include <string.h>
3
4   int main() {
5       char s1[30] = "University of C Programming";
6       ...
7       p = strchr(s1, 'v');
8       ...
9       return 0;
10  }
11
```

Listing 5: strings_example_6.c

- Note: *p - s1* is pointer arithematic that finds the index of character in string.
- Note: *p - s1* is long int.