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

```
#include <stdio.h>
2
      int main() {
3
          FILE *sample_file;
          sample_file = fopen("example_sources/sample.txt", "r");
          if (sample_file == NULL) {
               fprintf(stderr, "Error opening file \n");
               return 1;
          }
11
12
13
          return 0;
14
      }
15
16
```

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

```
#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>
1
2
      #define LINE_LENGTH 80
3
      int main() {
          FILE *sample_file;
6
          int error;
          char line[LINE_LENGTH + 1];
           sample_file = fopen("example_sources/sample.txt", "r");
10
11
           while (fgets(line, LINE_LENGTH + 1, sample_file) != NULL) {
               printf("%s", line);
13
          }
14
15
16
           return 0;
17
      }
18
```

• Reading from Input

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

```
#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)

```
#include <stdio.h>
1
2
      #define LINE_LENGTH 80
3
      int main() {
5
          FILE *sample_file;
6
          int error, score, total;
8
          sample_file = fopen("example_sources/sample.txt", "r");
9
          if (sample_file == NULL) {
10
               perror("Error opening file\n");
11
               return 1;
          }
13
14
          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);
          }
17
          error = fclose(sample_file);
19
          if (error != 0) {
```

```
perror("fclose failed on input file\n");
return 1;
}

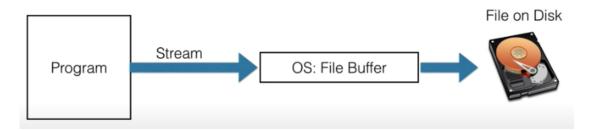
return 0;
}
```

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

```
#include <stdio.h>
          int main() {
               FILE *output_file;
4
               int error;
               int total = 50;
6
               float small_number = 0.125;
               output_file = fopen("example_sources/output.txt", "w")
               if (output_file == NULL) {
10
                   perror("Error opening file\n");
                   return 1;
12
               }
13
14
               fprintf(output_file, "The first line in the file\n");
               fprintf(output_file, "The integer is %d\n", total);
16
               fprintf(output_file, "The small float is %f\n",
17
     small_number);
18
19
               . . .
               return 0;
21
          }
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 \rightarrow some data may be lost

1 2

Files in C 5 of 5

• Bringing Everything Together

```
#include <stdio.h>
      int main() {
3
          FILE *sample_file, *output_file;
          int error_open, error_closed, score;
          int total = 50;
6
          sample_file = fopen("example_sources/sample.txt", "r");
          if (sample_file == NULL) {
               fprintf(stderr, "Error opening file \n");
               return 1;
11
          }
12
          output_file = fopen("example_sources/output.txt", "w");
14
          if (output_file == NULL) {
               perror("Error opening file\n");
16
               return 1;
          }
18
19
          while (fscanf(sample_file, "%d %d", &score, &total) == 2) {
20
               printf("Score: %d\n", score);
21
               fprintf(output_file, "Score: %d\n", score);
22
23
          }
          error_open = fclose(sample_file);
25
          if (error_open != 0) {
26
               perror("fclose failed\n");
27
28
               return 1;
          }
29
30
          error_closed = fclose(output_file);
31
```

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' = $['h', 'e', 'l', 'l', 'o', '\setminus 0']$
 - * 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

```
#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

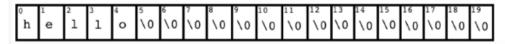
2. Using array of chosen size and double quoted string

```
#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

```
#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

```
#include <stdio.h>

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

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

Strings in C 2 of 6

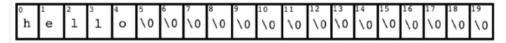
- Initializing Strings and String Literals
 - There are two ways
 - 1. Using array

```
#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



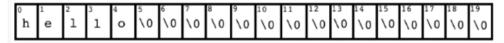
2. Using array of chosen size and double quoted string

```
#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

```
#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

```
#include <stdio.h>

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

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

```
return 0;
}
```

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

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

int main() {
        char weekday[10] = "Monday";
        printf("Length of string: %lu\n", strlen(weekday)); // <-
        Returns 6

        ...
        return 0;
}</pre>
```

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

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)

```
#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';
```

```
strncat(s1, s3, sizeof(s1) - strlen(s1) -1); // -1 is
for \0.
printf("%s\n", s1);
printf("%s\n", s2);
printf("%s\n", s1);
return 0;
}
```

Listing 4: strings_example_5.c

- · Note: sizeof(s1) strlen(s1) -1 is the remaining space in s1 excluding the null character.
- streat
 - * 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
 - * returns the index of first matching character

```
#include <stdio.h>
      #include <string.h>
3
      int main() {
          char s1[30] = "University of C Programming";
6
          p1 = strchr(s1, 'v');
          if (p1 == NULL) {
               printf("Character not found\n");
          } else {
11
               printf("Character found at index %d\n", (int)(p1 -
12
      s1)); // <- returns index 3</pre>
          }
14
          return 0;
      }
16
17
```

Listing 5: strings_example_6.c

- · Note: p1 s1 is pointer arithematic that finds the index of character in string.
- · Note: p1 s1 is long int.

- strstr

- * Syntax: char *strstr(const char *s1, const char *s2)
- * returns the index of the first character of matching string in s1.

```
#include <stdio.h>
      #include <string.h>
2
      int main() {
4
          char s1[30] = "University of C Programming";
5
          char *p1, *p2;
6
          p2 = strstr(s1, "Prog");
9
          if (p2 == NULL) {
10
               printf("String not found\n");
11
          } else {
12
              printf("String found at index %d\n", (int)(p2 - s1));
13
     // <- Returns index 16
14
          return 0;
15
      }
16
17
```

Listing 6: strings_example_6.c