CSC 209 Review 6 Solution

August 25, 2020

1 Exercises

1. I need to write which of the supplied function calls don't work and explain why.

   - `b)` String format in `printf` expects character constant, but string literal is used
   - `c)` String format in `printf` expects string but character constrant is used
   - `e)` The first argument in `printf` expects pointer but character constrant (an integer) is used isntead
   - `h)` The first argument in `putchar` expects a character, but string literal (a pointer to character) is used
   - `i)` The first argument in `puts` expects a pointer to character, but character constant (an integer) is used

   Notes

   - **putchar**
     - **Syntax:** `int putchar(int char)`
     - Writes a character (an unsigned char) specified by the argument char to stdout.
     - Does not append a new line to the output
     - Is similar to printf but for character
   - **puts**
     - **Syntax:** `int puts(const char *str)`
     - Writes a string to stdout up to but not including the null character
     - Appends a newline character to the output.
     - Is similar to printf but for string
   - **Character Constant**
     - **Syntax:** `' ... '`

  - Is represented by an integer
- **String Literal**
  - **Syntax:** `" ... "`
  - Has a sequence of characters inside
  - Ends with `\0`
  - Is represented by a pointer

  Example

  "When you come to a fork in the road, take it"
- **Escape Squences in String Literal**
  - A common example is '`\n`'
    - causes the cursor to advance to the next line

2. First, I need to write which of the provided function calls are legal, and write the output produced

   The solution to the first part is:

   - `b)` [output: a]
   - `c)` [output: abc]

   Second, I need to write which of the following function calls are illegal, and explain why.

   The solution to the second part is:

   - `a)` `purchar` expects a character constant (an integer) but a value of type pointer to `char` is used
   - `d)` `puts` expects a variable of type pointer to `char`, but a variable of type pointer to `char` is used

3. I need to write the values of `i`, `j`, `k` in the function

   ```
   scanf("%d%s%d", &i, s, &j)
   ```

   if the user enters `12abc34 56def78`.

   The solution to this problem is:

   - `i` - 12
   - `j` - abc34

- `k - 56`

4. I need to modify the following `read_line` function in the following ways:

```
int read_line(char str[], int n)
{
  int ch, i = 0;

  while ((ch = getchar()) != '\n')
    if (i < n)
      str[i++] = ch;
  str[i] = '\0';
  return i;
}
```

a) Have it skip white space beore beginning to store input characters

b) Have it stop reading at the first white-space character

c) Have it stop reading at the first new-line character, then store the new-line character in the string

d) Have it leave behind characters that it doesn't have room to store

The solution to this problem is:

a)

```
#include <ctype.h>
#include <stdbool.h>

...

int read_line(char str[], int n)
{
    int ch, i = 0;
    bool non_space_char_exists = false;

    while ((ch = getchar()) != '\n')
        if (isspace(ch) && non_space_char_exists){
            continue;
        }

        if (i < n)
            str[i++] = ch;
            non_space_char_exists = true;
    str[i] = '\0';
    return i;
}
```

b)

```c
#include <ctype.h>

...

int read_line(char str[], int n)
{
    int ch, i = 0;

    while ((ch = getchar()) != '\n')
        if (isspace(ch)){
            break;
        }

        if (i < n)
            str[i++] = ch;
    str[i] = '\0';
    return i;
}
```

c)

```c
#include <ctype.h>

...

int read_line(char str[], int n)
{
    int ch, i = 0;

    while ((ch = getchar()) != '\n')
        if (ch == '\n'){
            break;
        }

        if (i < n)
            str[i++] = ch;

    str[i] = '\n';
    str[i+1] = '\0';
    return i;
}
```

d)

```c
#include <ctype.h>

...

int read_line(char str[], int n)
{
    int ch, i = 0;
    int n = strlen(str) + 1;

    do {
        ch = getchar();

        if (!ch) {
            break;
```

```
            }

            str[i++] = ch;

        } while (i < (n - 1));

        str[i] = '\0';
        return i;
    }
```

Correct Solution

- c)

```
    #include <ctype.h>

    ...

    int read_line(char str[], int n)
    {
        int ch, i = 0;

        do {
            ch = getchar()

            if (ch == '\n'){
                break;
            }

            if (i < n)
                str[i++] = ch;

        } while (ch !== '\n');

        str[i] = '\0';
        return i;
    }
```

- d)

```
    #include <ctype.h>

    ...

    int read_line(char str[], int n)
    {
        int ch, i = 0;
        int n = strlen(str) + 1;

        do {
            ch = getchar();
```

```
12
13              if (ch == '\n') {
14                  break;
15              }
16
17              str[i++] = ch;
18
19          } while (i < (n - 1));
20
21          str[i] = '\0';
22          return i;
23      }
```

Notes

- Learned that `getchar()` always ends with `\n`

5. a) I need to write a function named `capitalize` that capitalizes all letters in its argument.

   The requirement for this function is:

   - Array subscripting must be used to access each character in string

   The solution to this problem is:

```
1   #include <ctype.h> // toupper
2
3   void capitalize(char *s)
4   {
5
6       for (int i = 0; s[i] != '\0'; i++) {
7           s[i] = toupper(s[i]);
8       }
9   }
```

   Notes

   - **Accessing the Characters in a String**
     1. Using array subscripting

        Example

```
int count_spaces(const char s[])
{
  int count = 0, i;

  for (i = 0; s[i] != '\0'; i++)
    if (s[i] == ' ')
      count++;
  return count;
}
```

2. Using pointer

   Example

```
int count_spaces(const char *s)
{
  int count = 0;

  for (; *s != '\0'; s++)
    if (*s == ' ')
      count++;
  return count;
}
```

b) I need to write a function named `capitalize` that capitalizes all letters in its argument.

The requirement for this function is:

- pointer must be used to access each character in string

The solution to this problem is:

```
1   #include <ctype.h> // toupper
2
3   void capitalize(char *s)
4   {
5       char *p = s;
6       while (*p != '\0') {
7           *p = toupper(*p);
8           p++;
9       }
10  }
```

6. I need to write a function `censor` that modifies a string by replacing every occurence of `foo` with `***`.

   The additional requirement of this function are:

   - I need to make the function as short as possible without sacrificing clarity.

   The solution to this problem is:

```c
#include <string.h> \\ strlen

void censor(char s[]) {
    char *p;

    if (strlen(s) < 3) {
        return;
    }

    for (p = &s[2]; p < s + strlen(s); p++) {
        if (tolower(*p) == 'o' &&
            tolower(*(p-1)) == 'o' &&
            tolower(*(p-2)) == 'f') {

            *p = '*';
            *(p-1) = '*';
            *(p-2) = '*';
        }
    }

}
```

Correct Solution

```c
#include <string.h> \\ strlen

void censor(char s[]) {
    if (strlen(s) < 3) {
        return;
    }

    for (char *p = &s[2]; *p != '\0'; p++) {
        if (tolower(*p) == 'o' &&
            tolower(*(p-1)) == 'o' &&
            tolower(*(p-2)) == 'f') {

            *p = *(p-1) = *(p-2) = '*';
        }
    }

}
```

```
18
```

7. I need to identify from the provided statements that which is not equivalent to others.

   The solution to this problem is:

   - `d)` All of the other statments are about making `str` null or empty.

   Notes

   - `*str = 0` makes pointer `NULL`
   - **strcpy**
     - **Syntax:** `char *strcpy (char *s1, const char *s2)`
     - Copies string `s2` to the string `s1`
   - **strcat**
     - **Syntax:** `char *strcat(char *s1, const char *s2)`
     - appends the contents of the string `s2` to the end of the string `s1`

   Example

```
strcpy(str1, "abc");
strcat(str1, "def");   /* str1 now contains "abcdef" */
```

8. I need to write the value of the string `str` after the following execution of statements

```
strcpy(str, "tire-bouchon");
strcpy(&str[4], "d-or-wi");
strcat(str, "red?");
```

   The solution to this problem is: `tired-or-winred?`

Correct Solution

The solution to this problem is: `tired-or-wired?`

Notes

- `strcpy` always copies upto the first null character.
  - The pointer stops and points at the first null character after `strcpy`

9. I need to write the value of the string `s1` after the executing the provided statements:

   The solution to this problem is: `computers`

Correct Solution

The solution to this problem is: `computers\0`

Notes

- **strcmp**
  - **Syntax:** `int strcmp(const char *s1, const char *s2)`
    - Compares string `s1` and `s2`
    - Returns
      - `0` - if `s1` and `s2` are identical
      - `>0` - if ASCII value of first unmatched character in `s1` is greater than `s2`
      - `<0` - if ASCII value of first unmatched character in `s1` is less than `s2`

10. I need to write what's wrong with the provided function.

    The solution to this problem is that the pointer `*q` hasn't allocated memory, and because of that, the function call `strcpy(q,p)` would result in segmentation fault.

11. Here I need to modify `strcmp` function to use pointer arithmetic.

    The solution to this problem is:

```
int strcmp (char *s, char *t) {
    char *p = s, *q = t;

    while (*p == *q) {
        if (*p == '\0') {
            return 0;
        }
        p++;
        q++;
    }

    return *p - *q;
}
```

12. I need to write the following function

    `void get_extension(const char *file_name, char *extension)`

    satisfying the following requirements:

    - If the file name doesn't have an extension, empty string should be stored instead
    - `get_extension` should be kept as simple as possible by using `strlen` and `strcpy`

    The solution to this problem is:

```
void get_extension(const char *file_name, char *extension) {
    int i = strlen(file_name) - 1;

    for (; i >= 0; i--) {
        if (*(file_name+i) == '.') {
            break;
        }
    }
    strcpy(extension, file_name + (i+1));
}
```

13. I need to write the following function

    `void build_index_url (const char *domain, char *index_url);`

    satisfying the following requirements:

    - `build_index_url` should add "http://www." to the beginning of the string
    - `build_index_url` should add "/index.html" to the end of the string
    - `build_index_url` should store the result in `index_url`

- `build_index_url` should be kept as simple as possible by using `strcat` and `strcpy`

The solution to this problem is:

```
1  void build_index_url (const char *domain, char *index_url) {
2      strcat(index_url, "http://www.");
3      strcat(index_url, domain);
4      strcat(index_url, "/index.html");
5  }
```

14. I need to write the output of the provided function.

The solution to this problem is: `Grinch`

Notes

- `--*p` means decrement `*p` first; the value of expression is `*p` after decrement
- Idioms are good to know. It's used by a lot of C programmers.
- **String Idioms - Searching for the end of string**
  - The following function `strlen` are equal

```
size_t strlen(const char *s)
{
  size_t n;

  for (n = 0; *s != '\0'; s++)
    n++;
  return n;
}
```

=

```
size_t strlen(const char *s)
{
  size_t n = 0;

  while (*s++)
    n++;
  return n;
}
```

It takes advantage of the fact that the end of string is `*s = '\0' = 0`

- **String Idioms - Copying string**
  - The following function `strlen` are equal

```
char *strcat(char *s1, const char *s2)
{
  char *p = s1;

  while (*p != '\0')
    p++;
  while (*s2 != '\0') {
    *p = *s2;
    p++;
    s2++;
  }
  *p = '\0';
  return s1;
}
```

=

```
char *strcat(char *s1, const char *s2)
{
  char *p = s1;

  while (*p)
    p++;
  while (*p++ = *s2++)
    ;
  return s1;
}
```

15. a) I need to find the value of `f("abcd","babc")` given the provided function `f`.

    The solution to this problem is: `3`

    b) I need to find the value of `f("abcd","bcd")` given the provided function `f`.

    The solution to this problem is: `0`

    c) I need to write what value `f` returns when two strings `s` and `t` are passed.

    The answer to this problem is: it returns the number of consequtive characters in `s` that's also in `t`.

16. I need to use the techniques of section 13.6 to condense the function `count_spaces` in section 13.4

    The solution to this problem is:

```
int count_spaces(const char s[])
{
    int count = 0;

    do {
        if (*s == ' ') {
            count++;
        }
    } while (*s++);

    return count;
}
```

17. I need to write the following function

    `bool test_extension (const char *file_name, const char *extension)`

    satisfying the following requiremnts

    - `test_extension` should return `true` if the file's extension matches the string pointed to by `extension`.
    - `test_extension` should ignore the case of letters
    - `test_extension` should use "search for the end of a string" idiom
    - `test_extension` should use `toupper` to make the process case-insensitive

    The solution to this problem is:

```
bool test_extension (const char *file_name, const char *extension)
{
    while (*file_name++ != '.')
        ;


    while (toupper(*file_name++) == toupper(*extension++)) {
        if (*file_name == '\0' && *extension == '\0') {
            return true;
        }
    }

    return false;
}
```

18. I need to write the function

    `void remove_filename(char *url)`

    satisfying the following requirements

    - `remove_filename` shold modify the string in `url` by removing the file name and the preceding slash

      `http://www.knking.com/index.html` → `http://www.knking.com/`

    - `remove_filename` should use "search for the end of a string" idiom

    The solution to this problem is:

```
void remove_filename(char *url)
{
    char *p = url;

    while (*p++)
        ;

    while (p-- > url) {
        if (*p == '/') {
            *p = '\0';
            return;
        }
    }
}
```

2 Programming Exercise

1. I need to write a program that finds the "smallest" and "largest" in a series of words.

   The requirement for this program are:

   - The program should ask the user to enter the words
   - The program should determine which words comes first and last as if the words are listed in dictionary order
   - The program must stop accepting input when the user enters a four-letter word
   - Assume program has no word more than 20 letters long
   - The program should use `smallest_word` and `largest_word` to keep trak of the "smallest" and "largest" words so far.
   - The program should use `strcmp` to compare with `smallest_word`
   - The program should also use `strcmp` to comapre with `largest_word`
   - The program should use `strlen` to determine when the user entered a four-letter word

   The solution to this problem is included in file `question_19.c`.

2. a) I need to improve the `remind.c` satisfying the following requirements:

      - The program should print an error message and ignore a reminder if the corresponding day is negative or larger than 31 using `continue` statement

      The solution to this problem is included in file `question_20_a.c`.

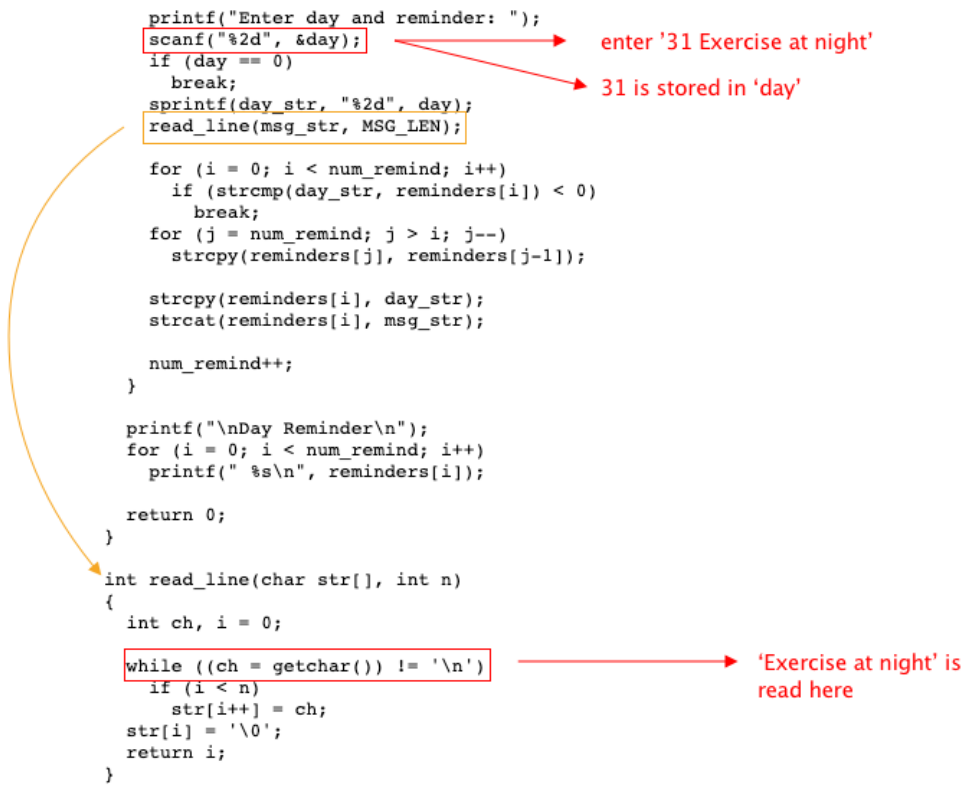
   b) I need to improve the `remind.c` satisfying the following requirements:

      - The user should enter a day, a 24-hour time, and a reminder.
      - The program should sort the printed reminder list first by day and then by time

      The solution to this problem is included in file `question_20_b.c`.

      Notes

      - Learned the unread characters in `scanf` are yielded



c) I need to improve the `remind.c` satisfying the following requirements:

- The program should print one-year reminder list.
- The program should require user to enter days in the form *month/day*

The solution to this problem is included in file `question_20_c.c`.

3. I need to modify `deal.c` program so that it prints the full names of the cards it deals.

The solution to this problem is included in file `question_21_c.c`.

Notes

- **Ragged Array**
  - Is a two dimensional array whose rows can have different lengths
  - Can be simulated by C language

  Example

```
char *planets[] = {"Mercury", "Venus", "Earth",
                   "Mars", "Jupiter", "Saturn",
                   "Uranus", "Neptune", "Pluto"};
```

4. I need to write a program that satisfies the following requirements:

   - The program should echoe its command-line arguments in reverse

   The solution to this problem is included in file `./question_22.c`.

   Notes

   - **Command Line Arguments**
     - **Syntax**

```
int main(int argc, char *argv[])
{
  …
}
```

       * `argc` Means 'arguement count'
       * `argv` Means 'argument vector' or an array of pointers to the command-line arguements

       Example

       `ls -l remind.c`

       Here,
       * `argc` is 3
       * `argv[0]` is `ls`
       * `argv[1]` is `-l`
       * `argv[2]` is `remind.c`

5. I need to write a program that adds up its command-line arguments, which are ssumed to be integers.

   The solution to this problem is included in file `question_23.c`.

   Notes

   - **atoi**
     - **Syntax:** `int atoi(const char *str)`
     - Converts the string argument str to an integer

6. I need to improve `planet.` program of section 13.7 satisfying the following requirements:

- The program should ignore case when comparing command-line arguments with string in `planets` array

The solution to this problem is included in file `question_24.c`.

7. I need to modify programming project 11 from chapter 5 satisfying the following requirements:

   - The program uses array containing pointers to strings instead of `switch` statements

   The solution to this problem is included in file `Question_25.c`.

   References

   1) Githib (William Gherman), c-solutions (Chapter 5 Project 11), link

8. I need to modify project 5 from chapter 7 to satisfy the following requirements:

   - The program includes the function `int compute_scrabble_value (const char *word)` that returns the SCRABBLE value pointed by `word`

   The solution to this problem is included in file `question_26.c`

   References

   1) Githib (William Gherman), c-solutions (Chapter 7 Project 5), link

9. I need to modify programming project from chapter 7 project 10 to satisfy the following requirements

   - The program includes `int compute_vowel_count(const char *sentence)`
   - The function `int compute_vowel_count(const char *sentence)` returns the number of vowels in the string pointed to by the `sentence` parameter

   The solution is included in file `question_27.c`.

   Notes

   - `scanf` scans "`%s`" upto white-space (i.e `\n`, `\0`)

   References

   1) Githib (William Gherman), c-solutions (Chapter 7 Project 10), link

10. I need to modify programming project chapter 7 project 11 to satisfy the following:

    - The program includes the function `void reverse_name(char *name)`
    - The original string may contain extra spaces between the first and last name, and after the last name
    - The function `reverse_name` should point to a string containg a first name followed by a last name
    - The function `reverse_name` should modify the string so the last name comes first, followed by a comma, a space, the first initial, and a period

    The solution to this problem is included in file `question_28.c`.

    References

    1) Githib (William Gherman), c-solutions (Chapter 7 Project 11), link

11. I need to modify programming project chapter 7 project 13 to satisfy the following:

    - The program includes the function `double compute_average_word_length(const char *sentence)`
    - The function `comput_average_word_length` returns the average length of the words pointed to by sentence

    The solution to this problem is included in file `question_29.c`.

    References

    1) Githib (William Gherman), c-solutions (Chapter 7 Project 13), link

12. I need to modify programming project chapter 8 project 14 to satisfy the following requirements:

    - The program stores words in a two dimensional `char` array as it reads the sentence, with each row storing a single word
    - Assume sentence contains no more than 30 words
    - Assume no word is more than 20 characters long

    The solution to this problem is included in file `question_30.c`.

    References

    1) Githib (William Gherman), c-solutions (Chapter 8 Project 14), link

13. I need to modify programming project chapter 8 project 15 to satisfy the following requirements

    - The program should include function `void encrpyt (char *message, int shift)`
    - The parameter `message` of function `encrypt` should point to a string to be encrpyted
    - The parameter `shift` of function `encrypt` should represent the amount which each letter to be shifted

    The solution to this problem is included in file `question_31.c`.

    References

    1) Githib (William Gherman), c-solutions (Chapter 8 Project 15), link