**CS1010 Programming Methodology**

Learning is not compulsory… neither is survival.

*~ W. Edwards Deming*

**Week 9: Characters and Strings (Answers)**

***To DLs:***

* Note that section I is for students to explore on their own, and need not be discussed in class, unless on their request.
* Please choose those questions you would like to discuss.
* At the end of your session, please set aside some time for students to practice. You may walk around to help weak students.

***To students:***

Many programs for this discussion can be downloaded from cs1010 account. For example, to copy **Week9\_Q1.c**, you can type:

cp ~cs1010/discussion/Week9\_Q1.c **.**

Please be reminded that **lab #4 deadline is this Saturday, 6pm**.

**I. Self-exploration (non-examinable)**

The questions in this section are meant for your self-study. **They are not likely to be discussed in class**, as we expect you to explore such additional knowledge on your own.

1. Character constants do not only appear in the form of single characters such as 'A' , '8' and '@'. Run the following program **Week9\_Q1.c**:

**#include <stdio.h>**

Download source code from cs1010 account

**int main(void)**

**{**

**int ch1 = '\062', ch2 = '\x41';**

**printf("ch1 = %c; ch2 = %c\n", ch1, ch2);**

**return 0;**

**}**

What is the output? Can you deduce the meaning of **'\062'** and **'\x41'**?

***Answer:***

The ouput is:

**ch1 = 2; ch2 = A**

062 and x41 are in octal and hexadecimal formats respectively. A leading 0, such as in 062, indicates an octal (base 8) number, and hence 062 is equivalent to decimal 50, which is the ASCII value of character '2'. A leading x, such as in x41, indicates a hexadecimal (base 16) number, and hence x41 is equivalent to decimal 65, which is the ASCII value of character 'A'.

2. Run the following program **Week9\_Q2.c** and deduce what the **atoi()** function does. Note that you need to include **<stdlib.h>** to use **atoi()**.

**#include <stdio.h>**

**#include <stdlib.h>**

**int main(void)**

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**{**

**char str[10];**

**int value;**

**printf("Enter input: ");**

**scanf("%s", str);**

**value = atoi(str);**

**printf("Value is %d.\n", value);**

**return 0;**

**}**

What does **atoi()** convert?

***Answer:***

The atoi() (ASCII to integer) function converts string into integer.

3. Refer to Tables 7.3 and 7.4 in the reference book, or look up the Internet, for the purpose of the function **strtok()**. Write a small program to illustrate its use.

**II. String basics**

4.

(a) Assuming that a username can contain up to 8 characters, Brusco wrote this:

**char username[8];**

**. . .**

**scanf("%s", username);**

What is wrong with Brusco’s code?

***Answer:***

The array username should be declared to be at least 9 slots, to cater for the null character '\0':

char username[9];

Another issue is that %s can only read a word. Therefore if a user name contains blank, it cannot be correctly stored in the array.

(b) What will happen if Brusco writes the following code?

**char fruitname[8];**

**. . .**

**strcpy(fruitname, "pineapple");**

**printf("%s\n", fruitname);**

***Answer:***

Students may not see what’s wrong. They may (most likely actually) get “pineapple” as the output on sunfire and it seems there is nothing wrong. However, since “pineapple” is more than 8 characters, it spills into “unauthorized” memory space. Theoretically this is wrong and sometimes your program may crash because of this.

5. Given the following program **Week9\_Q5.c**, what could be the problem?

**#include <stdio.h>**

**int main(void)**

**{**

**char board[2][3] = { {'a','b','c'}, {'d','e','f'} };**

**int i;**

**for (i=0; i<2; i++)**

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**printf("%s\n", board[i]);**

**return 0;**

**}**

***Answer:***

It depends on what values are stored in the memory after the array board. Assuming that it is the case below:

**. . .**

a

b

c

d

e

f

W

;

\0

p

[0][0]

[1][2]

Since %s picks up from the starting character specified and ending at a null character '\0', the output would be:

**abcdefW;**

**defW;**

Even if '\0' happens to be in right after the sixth element, the output would be:

**abcdef**

**def**

6. Given the following program **Week9\_Q6.c**, what is the problem?

**#include <stdio.h>**

**#include <string.h>**

Download source code from cs1010 account

**int main(void)**

**{**

**char \*fruit1 = "apple", \*fruit2 = "apple";**

**char \*str1 = "yes", \*str2 = "yes";**

**fruit1 = str1;**

**printf("%s\n", fruit1);**

**strcpy(fruit2, str2);**

**printf("%s\n", fruit2);**

**return 0;**

**}**

***Answer:***

The **strcpy()** statement gives a segmentation fault. The **strcpy()** function attempts to copy the characters of the string (“yes”) pointed to by str2 into the space pointed to by fruit2. However, fruit2 is pointing to a string literal, which is a read-only space.

7. [CS1010 AY2010/2011 Semester 1 Exam, Q2b]

Write down the output of the following program.

**#include <stdio.h>**

Download source code from cs1010 account for verification after manual tracing

**int functionXYZ(char \*, char);**

**int main(void)**

**{**

**char s[] = "abbacadaba";**

**printf("%d\n", functionXYZ(s, 'b'));**

**return 0;**

**}**

**int functionXYZ(char \*str, char ch)**

**{**

**int i=0, j=0;**

**while (str[i])**

**if (str[i++] == ch)**

**j++;**

**return j;**

**}**

***Answer:***

3

**III. Programming on Strings**

Download skeleton **Week9\_Q8.c** from cs1010 account

8. Write your own version of **strlen()** function and name it **mystrlen()**.

***Answer: in slides***

9. [CS1010 AY2010/1 Semester 1 Exam Q5]

Write a function **void convert\_string(char \*str, char \*dest)** that converts **str** into **dest** by adding an asterisk between each letter in **str**. Any blank space in **str** is also replaced by an asterisk.

You may assume that there is one blank space between two words, and only letters and spaces appear in **str**. You may also assume that **dest** has sufficient space to hold the lengthened string.

For example, if **str** is

Download skeleton **Week9\_Q9.c** from cs1010 account

**The quick brown fox**

then **dest** will be

**T\*h\*e\*q\*u\*i\*c\*k\*b\*r\*o\*w\*n\*f\*o\*x**

The above is an exam question. For this discussion, write a complete program that reads a string with at most 20 characters, and calls the **convert\_string()** function.

***Answer:*** See **Week9\_Q9.c**

10. See Week 9 lecture slides: Exercise #4: Hangman Game version 2.

Modify the program **Week9\_Hangman\_ver1.c** to **Week9\_Q10.c** as follows:

* Keep a list of 10 words (or more if you like) and randomly choose a word from this list for the user to guess. Each word is at most 15 characters long.
* Allow user the option to exit the game or continue another game.

***Answer:*** See **Week9\_Q10.c**

11. [CS1101 AY2005/6 Semester 1 Exam Q6] *Pig Latin* is a language game of alterations played in English. We will use a simple version here.

* For a word starting with a consonant, move that first consonant to the end of the word and append “ay”. Examples: “computer” becomes “omputercay”, “program” becomes “rogrampay”.
* For a word starting with a vowel, simply append “way” to the word. Examples: “able” becomes “ableway”, “only” becomes “onlyway”.

Write a program **Week9\_Q11.c** to read in a sentence comprising words in lowercase, and convert the sentence into Pig Latin. You may assume that there is only one space separating two words. You may make other appropriate assumptions.

A sample run:

Enter sentence: **my cat likes to eat fish**

Converted: ymay atcay ikeslay otay eatway ishfay

***Answer:*** See **Week9\_Q11.c**

There should be many ways to solve this problem. This problem might be okay for the better students, but the weaker ones may have problem.