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C: an introduction

Strings: basics

char

- C supports the **char data type** for storing a single character.
- char uses one byte of memory, encoded as numbers using the ASCII scheme.
- char constants are enclosed in **single quotes** `char myGrade = ‘B’;`
- Use %c in printf( ) to print a single character.
- using %c with scanf( ) to input a single character.

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Special characters

- \ is used to indicate that the char that follows has special meaning.
  - \n is the newline character
  - \t is the tab character
  - \” is the double quote
  - \’ is the single quote
  - \\ is the backslash

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Character library ctype

- `#include <ctype.h>`

- `int isdigit (int c);`
  - Determine if c is a decimal digit (‘0’ - ‘9’)
- `int isalpha (int c);`
  - Determines if c is an alphabetic character (‘a’ - ‘z’ or ‘A- ‘Z’)
- `int isspace (int c);`
  - Determines if c is a whitespace character (space, tab)
- `int tolower (int c);`
  - Returns c changed to lower-case
- `int toupper (int c);`
  - Returns c changed to upper-case

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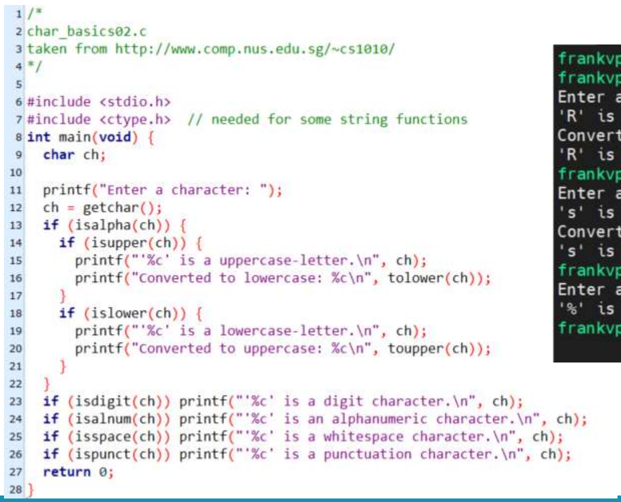
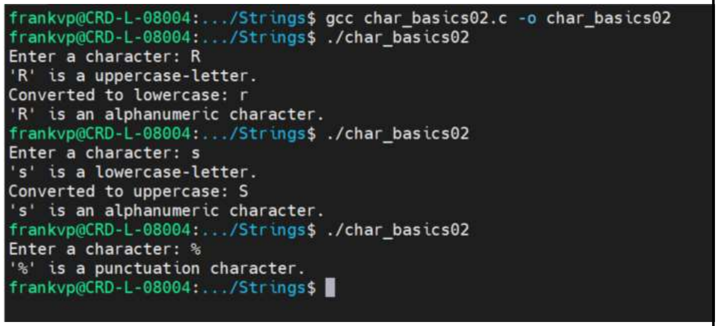


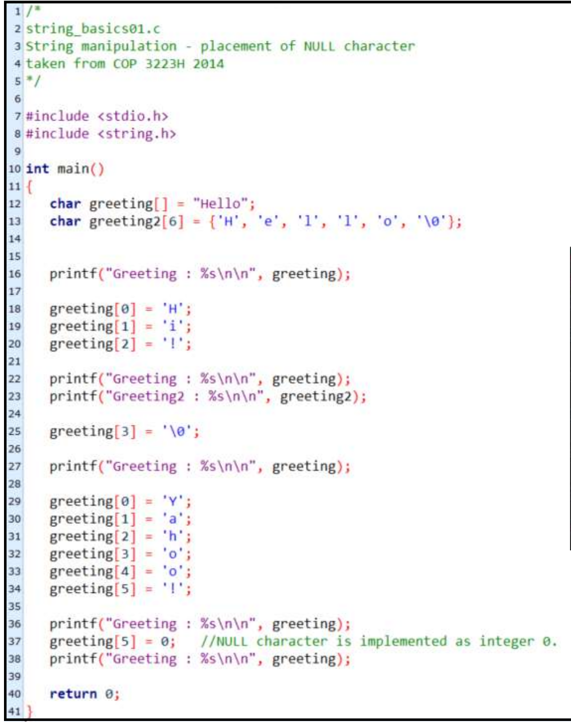
```c
/*
char_basics02.c
taken from http://www.comp.nus.edu.sg/~cs1010/
*/

#include <stdio.h>
#include <ctype.h>  // needed for some string functions
int main(void) {
  char ch;

  printf("Enter a character: ");
  ch = getchar();
  if (isalpha(ch)) {
    if (isupper(ch)) {
      printf("'%c' is a uppercase-letter.\n", ch);
      printf("Converted to lowercase: %c\n", tolower(ch));
    }
    if (islower(ch)) {
      printf("'%c' is a lowercase-letter.\n", ch);
      printf("Converted to uppercase: %c\n", toupper(ch));
    }
  }
  if (isdigit(ch)) printf("'%c' is a digit character.\n", ch);
  if (isalnum(ch)) printf("'%c' is an alphanumeric character.\n", ch);
  if (isspace(ch)) printf("'%c' is a whitespace character.\n", ch);
  if (ispunct(ch)) printf("'%c' is a punctuation character.\n", ch);
  return 0;
}
```



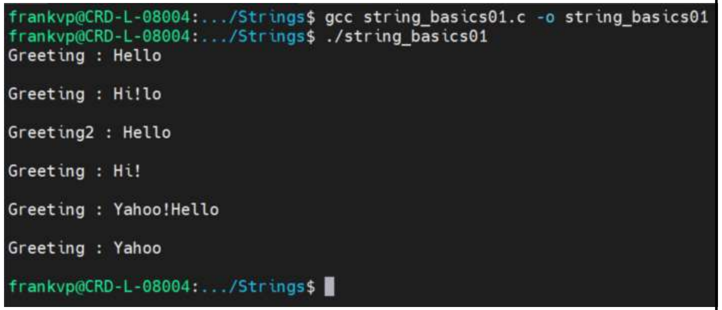
```
frankvp@CRD-L-08004:.../Strings$ gcc char_basics02.c -o char_basics02
frankvp@CRD-L-08004:.../Strings$ ./char_basics02
Enter a character: R
'R' is a uppercase-letter.
Converted to lowercase: r
'R' is an alphanumeric character.
frankvp@CRD-L-08004:.../Strings$ ./char_basics02
Enter a character: s
's' is a lowercase-letter.
Converted to uppercase: S
's' is an alphanumeric character.
frankvp@CRD-L-08004:.../Strings$ ./char_basics02
Enter a character: %
'%' is a punctuation character.
frankvp@CRD-L-08004:.../Strings$
```

Strings

- C has no string handling facilities built in; consequently, strings are defined as arrays of characters.
- Strings are null-terminated (\0’) arrays of characters.
- Constant character strings are written inside **double-quotation marks “**
- Single character variables are declared using single-quotation marks ’
- Use %s in printf( ) to print a string.



```c
/*
string_basics01.c
String manipulation - placement of NULL character
taken from COP 3223H 2014
*/

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

int main()
{
    char greeting[] = "Hello";
    char greeting2[6] = {'H', 'e', 'l', 'l', 'o', '\0'};


    printf("Greeting : %s\n\n", greeting);

    greeting[0] = 'H';
    greeting[1] = 'i';
    greeting[2] = '!';

    printf("Greeting : %s\n\n", greeting);
    printf("Greeting2 : %s\n\n", greeting2);

    greeting[3] = '\0';

    printf("Greeting : %s\n\n", greeting);

    greeting[0] = 'Y';
    greeting[1] = 'a';
    greeting[2] = 'h';
    greeting[3] = 'o';
    greeting[4] = 'o';
    greeting[5] = '!';

    printf("Greeting : %s\n\n", greeting);
    greeting[5] = 0;   //NULL character is implemented as integer 0.
    printf("Greeting : %s\n\n", greeting);

    return 0;
}
```



```
frankvp@CRD-L-08004:.../Strings$ gcc string_basics01.c -o string_basics01
frankvp@CRD-L-08004:.../Strings$ ./string_basics01
Greeting : Hello

Greeting : Hi!lo

Greeting2 : Hello

Greeting : Hi!

Greeting : Yahoo!Hello

Greeting : Yahoo

frankvp@CRD-L-08004:.../Strings$
```

Initializing character strings

- Initializing a string:
  - `char word[] = "Hello!";`

  equivalent with:
  - `char word[] = { 'H', 'e', 'l', 'l', 'o', '!', '\0' };`
- The null string: A character string that contains no characters other than the null character
  - char empty[]= "";
  - char buf[100]= "";
- Initializing a very long string over several lines:
  - char letters[] = { "abcdefghijklmnopqrstuvwxyz\
    ABCDEFGHIJKLMNOPQRSTUVWXYZ" };

C string library

- The C library supplies several string-handling functions. To use the string functions, include **`<string.h>`**
- Commonly used functions.
  - **`strcat`**
  - **`strlen`**
  - **`strcpy`**
  - **`strcmp`**
- *File: string_strlen.c*
- *File: string_strcmp.c*
- *File: string_manip.c*

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String functions

- `strcpy(s1, s2)` – Copies the string s2 to s1
  - `s1 = s2` assignment is not working
- `strcat(s1, s2)` – Concatenates string s2 to the end of s1, putting \0 at the end.
- `strcmp(s1, s2)` – Compares strings s1 and s2 and returns a value:
  - less than zero if s1 < s2,
  - equal to zero if s1 == s2,
  - greater than zero if s1 > s2.
- `strlen(s)` – Returns the number of characters in s, excluding \0

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