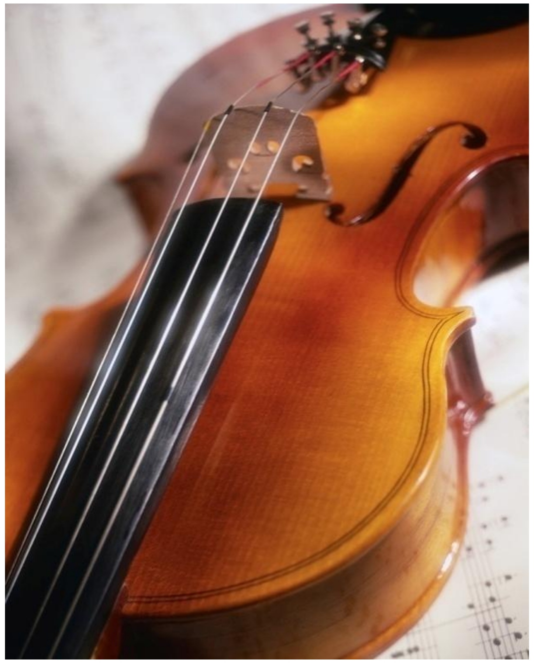
CHARACTERS AND STRINGS

CSSE 120—Rose Hulman Institute of Technology

Characters and Strings



Characters in Python

- Just a one-character ***string***

```
>>> myChar = 'C'
>>> print myChar
C
>>> print ord(myChar) # converts character to int
67
>>> print chr(67)          # converts int to character
C
```

Characters in C

- C's **char** type is really a kind of number!
- A **char** takes 1 byte of storage space
- Predict the output:

```
char myChar;
myChar = 'C';
printf("%c\n",  myChar);   /* %c is format spec. for char */
printf("%d\n", myChar);
printf("%c\n", 67);
myChar++;
printf("%c\n",  myChar);
```

Q1

Seven Ways to Say 'A'

```
int i = 'A';
printf("A");
printf("%c", 'A');
printf("%c", 'B'-1);
printf("%c", i);
putchar('A');   /* can "push" single characters to output */
putchar(toupper('a'));  /* Need to #include <ctype.h> */
putchar(i);
```

Seven Ways to Say 'A'

```
int i = 'A';
printf("A");
printf("%c", 'A');
printf("%c", 'B'-1);
printf("%c", i);
putchar('A');   /* can "push" single characters to output */
putchar(toupper('a'));  /* Need to #include <ctype.h> */
putchar(i);
printf("Eh!");
```

Summary: Math with Characters

```
'C' + 1 == 'D'
char b = 'b';
b--;
putchar(b);  /* outputs a */
```

- Combine these ideas to write a **for** loop that prints the characters from 'a' to 'z' on a single line
  - Try this in Eclipse; you may work with a neighbor
  - Write your answer on your quiz

Character Input

- To read a single character from the console use:
  - **getchar()**
  - Caveat: **getchar()** returns an **int**, either a **char** value or **EOF** (end of file)

Note: most operating systems only pass characters to your program after the user presses the **enter** key

```
int inChar;
int count = 0;
printf("\n\nType some text, then press 'Enter': ");
fflush(stdout);
inChar = getchar();
while (inChar != '\n') {
       count++;
       inChar = getchar();
}
printf("\nYou entered %d characters.", count);
```

Q4

Character Functions: *ctype.h*

- Conversion Functions:
  - **int tolower(int c);**
  - **int toupper(int c);**
- Test functions:
  - **isdigit(c)**
  - **isalpha(c)**
  - **islower(c)**
  - **isupper(c)**
  - **isspace(c)**

See the C *Library Reference* link on ANGEL under Course Resources for more functions.

Just Stringing You Along

- A string in C is just
  - An array of characters,
  - with a '\0' at the end
- Examples:
  - **char fname[] = "Lou";** **char lname[10];**

…note difference in box-and-pointer diagrams

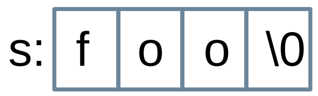
- How would we assign “Gehrig” to lname?
  1. char lname[] = “Gehrig”
  2. character-by-character assignment
  3. strcpy(coming soon)

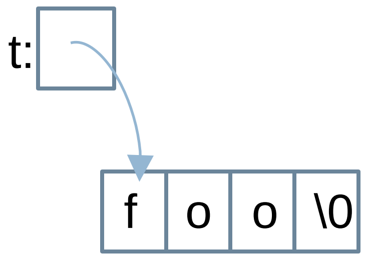
Q5-Q7

String variables vs. constants

- String Variable
- char s[] = “foo”;

- String Constant
- char *t = “foo”;
- Strings declared in this way **cannot** be mutated!





String Functions: *string.h*

Function	Purpose
char *strcpy(char *dest, char* src)	copy string src to string dest, including '\0'; return dest **Note: strings are *mutable* in C, unlike Python! Must reserve space for dest before calling strcpy**
char *strcat(char *dest, char* src)	concatenate string src to end of dest; return dest. **Must reserve space for dest before calling strcat**
int strcmp(char *str1, char *str2)	compare string str1 to string str2, return a negative number if str1<str2, zero if str1==str2, or positive otherwise
size_t strlen(char *str)	return length of str (size_t is a typedef for int on most systems)

Note: we usually ignore the return values from strcpy and strcat, since they mutate dest.

See Kochan or the C *Library Reference* link on ANGEL for more.

String Concatenation Using *strcat()*

- Consider:

```
char s1[] = "Go, Red! Go, White! ";
char s2[] = "Go Rose, Fight!";
/* ??? */
printf("%s\n", s3);
```

- What goes in the space? We want:
  - the output to be
    `Go, Red! Go, White! Go Rose, Fight!`
  - and no additional string literals

Summary: Strings in C

- Strings are arrays of characters:
  - **char fname[] = "Lou";**

  or

  - **char lname[10];**
    strcpy(lname, “Gehrig”);

Key Points!

- "Null terminated", that is, a '\0' at the end

- Don't forget to reserve enough space to hold the string

Q9

When C Gives You Lemons…

- Problem:
  - Python includes high level functions for strings
  - C (and some other languages) do not
  - What if you need to use C, but also need strings?
- Solution: Make your own string functions!
- Homework:
  - Check out ***Session26CharactersAndStrings*** from SVN
  - Let's start it together.