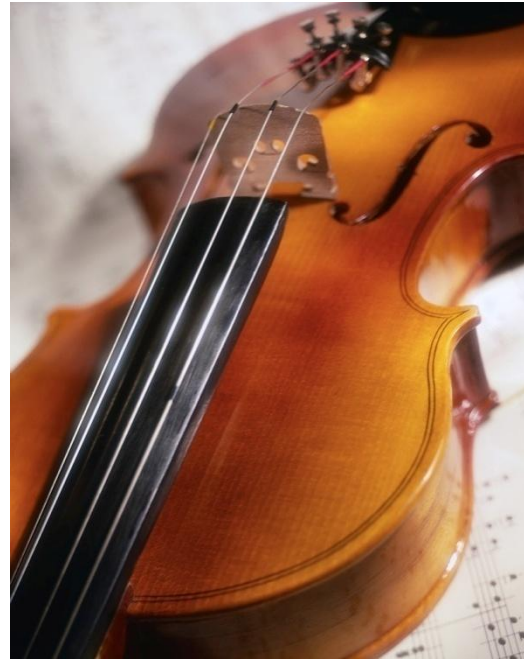


CHARACTERS, STRINGS, AND FILES

CSSE 120—Rose Hulman Institute of Technology

Characters, Strings, and Files



Characters in Python

- Just a special case of *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
- Example:

```
char myChar;
```

```
myChar = 'C';
```

```
printf("%c\n", myChar); /* %c is format spec. for char */
```

```
printf("%d\n", myChar); /* can print char as a decimal */
```

```
printf("%c\n", 67); /* can print int as char */
```

```
myChar++;
```

```
printf("%c\n", myChar); /* What prose do you suppose? */
```

Ten Ways to Say 'A'

```
char c = 'A';
int i = 'A';
printf("A");
printf("%c", 'A');
printf("%c", 'B'-1);
printf("%c", c);
printf("%c", i);
putchar('A'); /* can "push" single characters to output */
putchar('C' - 2);
putchar(toupper('a')); /* Need to #include <ctype.h> */
putchar(c);
putchar(i);
```

Math with Characters

- We can do math with character types:
 - `'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, work with a neighbor
 - Write your answer on your quiz

Getting Characters

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

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

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

Character Functions: *ctype.h*

- Conversion Functions:
 - ▣ `int tolower(int c);`
 - ▣ `int toupper(int c);`
- Modify `getSomeChars()` to:
 - ▣ print each character entered
 - ▣ print the upper-case version of each character
- Test functions:
 - ▣ `isdigit(c)`
 - ▣ `isalpha(c)`
 - ▣ `islower(c)`
 - ▣ `isupper(c)`
 - ▣ `isspace(c)`
- Count the number of spaces entered

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

Just Stringing You Along

- "Strings" in C are just
 - ▣ arrays of characters,
 - ▣ with a '\0' at the end
- Example:
 - ▣ **char lname[10];**
- Example, string constants:
 - ▣ **char *fname = "Lou";**
- When would we use the 1st declaration? the 2nd?

Programming Exercise

- Write a function **getline()**
 - Signature: **int** `getline(char s[], int lim);`
 - Spec:
 - Gets a line of characters from the user and puts up to *lim* characters of it in the given array. Returns the length of the string.
- Example calling code:

```
char lname[MAX_NAME];  
int len;  
len = getline(lname, MAX_NAME);  
printf("\n\n'%s', has %d characters.\n",  
        lname, len);
```

String Functions: *string.h*

Function	Purpose
<code>char *strcpy(char *s, char* ct)</code>	copy string ct to string s, including '\\0'; return s
<code>char *strcat(char *s, char* ct)</code>	concatenate string ct to end of string s; return s
<code>int strcmp(char *cs, char *ct)</code>	compare string cs to string ct, return a negative number if $cs < ct$, zero if $cs == ct$, or positive otherwise
<code>char *strstr(char *cs, char *ct)</code>	return a pointer to first occurrence of ct in cs, or NULL if not present
<code>size_t strlen(char *cs)</code>	return length of cs (size_t is an typedef for int on most systems)

Descriptions from K&R, p. 249.

See 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 constants

Summary: Strings in C

- Strings are arrays of characters:
 - `char lname[10];` or
 - `char *fname = "Lou";`
- "Null terminated", that is, a `'\0'` at the end
- Don't forget to reserve enough space to hold the string



Arrays of Strings

- Arrays of ints:
 - `int x;` // an element
 - `int xA[4];` or `int *xA;` // an array of ints
- Strings are arrays of chars:
 - `char c;` // an element
 - `char str[4];` or `char *str;` // a string, i.e., an array of chars
- So what's an array of strings?
 - `char *str;` // an element
 - `char *strA[4]` or `char **strA;` // an array of strings

When C Gives You Lemons...

- Problem:
 - ▣ Python includes high level functions for strings
 - ▣ C (and other languages) do not
 - ▣ What if you need to use C, but also need strings?
- Solution:
 - ▣ Make your own string functions!
- Homework:
 - ▣ Check out ***CharsStringsFiles*** from your SVN repository
 - ▣ See homework description linked from ANGEL