CMSC 106
Lecture Set #11 - Strings

Set Started:
Tuesday, November 13, 2007

C-Strings

- Definition
  - An array of characters
  - Where the used portion is terminated by a null character
- <string.h>
  - Library that acts on C-strings
  - Most will crash if given something that does not fit the definition above
- Creating and Initializing a string

char name1[4] = {'J','a','n','\0'};
char name2[6] = "Plane";

- Characters, strings and numeric values are all different

$$"0" \neq '0' \neq 0$$

length of the string and the sizeof operator
  - sizeof operator tells the size of the variable or type
  - strlen uses the definition of C-string to find number of used characters

Input and Output

- Output
  - %s in printf format string
  - puts() function takes a string as the only argument
- Input
  - dangerous to use %s in scanf or to use gets() function
  - `char *fgets(char *buffer, int bufferSize, FILE *stream);`
    - read a line into buffer (at most bufferSize-1 characters)
      - null byte added at end of buffer
    - reads from stream – for standard input just type **stdin** as the name of the stream
    - returns NULL on error or end of file
    - on success returns pointer to the space where you read into (here called the buffer)

Strings

- Zero or more characters followed by null char '\0'
  - also called NUL
  - not counted as part of string
  - string.h defines prototypes for string routines
- Copying Strings
  - size_t strlen(char const *str);
    - returns count of characters in str
    - up to but not including the null character
  - char *strncpy(char *dst, char const *src, size_t len);
    - copy src to dst
    - copy until '\0' in src or at most len characters
    - pad extra characters will '\0'
    - Safety tip: dst[len-1] = '\0'; to force termination of new string
  - char *strncat(char *dst, char const *src, size_t len);
    - append src onto the end of dst
    - always appends NUL to end of dst string

String Functions

- Comparison
  - int strncmp(char const *s1, char const *s2, size_t len);
    - returns 0 if string equal up to len
    - returns a negative value if s1 is less than s2
    - returns a positive value if s1 is greater than s2
- Searching
  - char *strchr(char const *str, int ch);
  - char *strrchr(char const *str, int ch);
    - finds the first occurance of ch in str
    - strrchr finds the last occurance
    - returns NULL if not found
  - char *strstr(char const *s1, char const *s2);
    - find the first occurrence of s2 in s1

String Functions Examples

```
char string[] = "this is a test string";
char *ans;
int length;

length = strlen(string);
                        /* returns 21 */
ans = strchr(string, 'h');
                        /* returns string + 1 */
ans = strrchr(string, 't');
                        /* returns string + 16 */
ans = strstr(string, "test");
                        /* returns string + 10 */
```

Character Functions

Prototypes in ctype.h

- Classifying characters
  - parameter is int, but it's a character
  - int isspace(int ch);
    - returns true if ch ' ', '\n', '\t', form feed, or carriage return
  - int isdigit(int ch);
    - returns true if its 0 through 9
  - int islower(int ch); and isupper(int ch);
    - return true if it's a-z for islower and A-Z and isupper
  - int isalpha(int ch);
    - returns true if it's a-z or A-Z
  - int isalnum(int ch);
    - returns true if it's a-z or A-Z or 0-9
- Transformation
  - int toupper(int ch), int tolower(int ch)
    - converts to upper/lower case

typedef

- Allows you to define a new type
- Format:

typedef whatItIs whatYouWantToCallIt;

- For example:

typedef int Bool;

- Array example:

typedef char MyString[MAX];