ECE 471 – Embedded Systems
Lecture 27

Vince Weaver

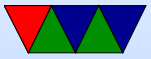
http://web.eece.maine.edu/~vweaver

vincent.weaver@maine.edu

7 November 2022

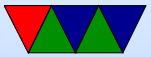
Announcements

- HW#8 was posted
- Midterm #2 on November 18th



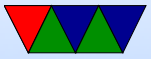
HW#8 – C string review

- String manipulation is famously horrible in C.
- There are many ways to get the "YES" and "t=24125" values out of the text file for HW#8.
- Any way you choose is fine.



Method One – File I/O Using fscanf()

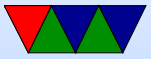
- The "stream" file interface in C lets you used buffered I/O and is slightly higher level than `open()`/`close()`
- Open a file with: `FILE *fff;`
  `fff=fopen("filename","r");`
  Check for errors! fff==NULL if it fails to open
- close a file with `fclose(fff);`
- you can read a string using `fscanf(fff,"%s",string);`
  One helpful hint, putting a '*' in a conversion (like `%*s` tells scanf to read in the value but ignore it.



Method Two – Read Entire File into RAM

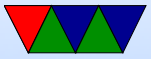
- There are multiple ways to read files into a string in C
  Assume `char string[1024];`
  - `fd=open("filename",RD_ONLY);`
    `read(fd,string,1023); close(fd);`
  - `FILE *fff; fff=fopen("filename","r");`
    `fread(buffer,size,count,fff); fclose(fff)`

  - Advanced: use `mmap()`
  - You can also use `fgets(buffer,size,fff);` to bring



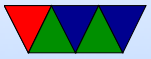
in one line at a time

- Once the whole thing is in memory, you can use `strstr()` or similar to search for substrings, i.e. `strstr(string,"NO");`

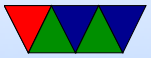


C String Review

- In C, characters are NUL (0) terminated character arrays (usually 8-bit bytes). Usually ASCII or UTF8
- Other languages might be unicode, 16-bit, wchar
- You can use either pointer or array access to get a value (string[0] is the same as *string)
- Note that double quotes indicate a string, while single quotes indicate a single character
- It is very easy to accidentally go off the end of a string and corrupt memory

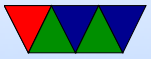


- Alternatives? Fancy libraries? Pascal strings (where first char is the length?)
- Always be sure your strings are terminated, otherwise bad things can happen (and not all C string manipulation functions do this properly, see strcpy(), strncpy(), strlcpy()



Finding a location / substring in a larger string

- If you trust the Linux kernel developers to keep a "stable ABI" you can assume the temperature will always be a fixed offset and hard code it. This can be a bit dangerous.
- You can use the `scanf()` series of functions to parse the string (either fscanf() directly, or sscanf() on the string) One helpful hint, putting a '*' in a conversion (like `%*s` tells scanf to read in the value but ignore it.

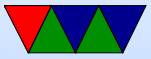


- You can use the `strstr()` search for substring C-library function, maybe in conjunction with `strtok()`
- You can manually parse the array.
  Using array syntax, something like:

```
i=0; while(string[i]!=0) {
if (string[i]=='t') break; i++ }
```

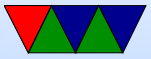
  Using pointer syntax, something like:

```
char *a; a=string; while(*a!=0) {
if (*a=='t') break; a++; }
```



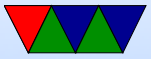
Pointing into a string

- If you searched for "t=" you might now have a pointer a to something like "t=12345". To point to 12345 you can just add 2 to the string pointer.
- `printf("%s\n",string+2);`
- `printf("%s\n",&string[2]);`



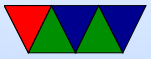
Converting string to decimal or floating point

- `atoi()` converts string to integer. What happens on error?
- `strtol()` will give you an error but is more complex to use
- `atof()` and `strtod()` will do floating point



Comparing strings

- Can you just use ==? NO!
- Be careful using `strcmp()` (or even better, `strncmp()`
  they have unusual return value
  less than, 0 or greater than depending. 0 means match
  So you want something like
  `if (!strcmp(a,b)) do_something();`



Other Ways to access file

- Other file I/O: `fgetc()`
- `mmap()`