For this assignment you are to modify and extend an existing Linux program that uses sockets to connect to a given http server. The program that you are to modify and extend is located on the course website. Your program will be compiled and tested on cs-course36.cs.uidaho.edu, so you should at least test it there before you turn it in.

1 The Current Program

The program that you are going to modify and extend is currently called get-ex. The get-ex program uses sockets to open a connection to www.example.com port 80 and read the / resource located on that site. If you compile and run get-ex on cs-course36.cs.uidaho.edu you will see the following:

```bash
-bash-4.1$ gcc get-ex.c -o get-ex
-bash-4.1$ ./get-ex
HTTP/1.1 200 OK
Cache-Control: max-age=604800
Content-Type: text/html; charset=UTF-8
Date: Thu, 01 Nov 2018 21:53:55 GMT
Etag: "1541025663+ident"
Expires: Thu, 08 Nov 2018 21:53:55 GMT
Last-Modified: Fri, 09 Aug 2013 23:54:35 GMT
Server: ECS (oxr/8313)
Vary: Accept-Encoding
X-Cache: HIT
Content-Length: 1270
Connection: close

<!doctype html>
<html>
<head>
<title>Example Domain</title>
<meta charset="utf-8" />
<meta http-equiv="Content-type" content="text/html; charset=utf-8" />
<meta name="viewport" content="width=device-width, initial-scale=1" />
<style type="text/css">body { background-color: #f0f0f2;
```
You should ensure that get-ex behaves as shown above before you begin working on this assignment. Dates and times will change depending on when you run the command, but the rest should be very similar.
2 Your Program

The current get-ex program is not very generalized and is contained within a single function. Your goal in this assignment is to modify and extend get-ex to produce a program named get-any. Your get-any program will be able to initialize and connect to any valid website specified by the user and perform an HTTP GET to request any valid resource specified by the user on that website. The current get-ex program only uses HTTP 1.1. You can continue to use this, or can change your code to use HTTP 2.0.

Your get-any program will display to stdout the HTTP data that is received from the requested website, just as the current get-ex program does. In addition to displaying the requested data, your program will gather information about the data received or perform transformations on that data.

2.1 Program Options

The syntax of the get-any program is as follows:

    get-any hostname resource -[FIS]

The hostname and resource arguments are required and must be specified in the order shown. The hostname argument is the name of the web server that the user wants to connect to. The resource argument is the name of the resource that the user wants to retrieve from the requested server. The other arguments to get-any are optional, but if any appear, only one may appear at any given time. These options specify which transformations are to be performed on the data, or which information about the data is to be gathered and presented. These options are:

- F This option is used to specify that a frequency count of all bytes of data retrieved from the host is to be calculated and displayed to stdout after the data that was retrieved is displayed to stdout.

- I This option is used to specify that an inverted sequence of all bytes of data retrieved from the host is to be displayed to stdout after the data that was retrieved is displayed to stdout.

- S This option is used to specify that an sorted sequence of all bytes of data retrieved from the host is to be displayed to stdout after the data that was retrieved is displayed to stdout.

2.2 Examples

This section contains examples describing how your get-any program should behave. Please examine these examples closely and do your best to mimic the behavior shown herein.
2.2.1

-bash-4.1$ get-any www.wut.com /public.html

This command will provoke get-any to open a connection to www.wut.com on port 80 and attempt to retrieve the resource /public.html. The get-any command will then display whatever the result of the HTTP GET is to the computer screen and immediately exit. An example of what might appear as a result of using this command is shown below.

-bash-4.1$ get-any en.wikipedia.org /
HTTP/1.1 301 TLS Redirect
Date: Thu, 01 Nov 2018 22:51:49 GMT
Server: Varnish
X-Varnish: 865522146
X-Cache: cp2013 int
X-Cache-Status: int-front
Set-Cookie: WMF-Last-Access=01-Nov-2018;Path=/;HttpOnly;secure;Expires=Mon, 03 Dec 2018 12:00:00
Set-Cookie: WMF-Last-Access-Global=01-Nov-2018;Path=/;Domain=.wikipedia.org;
X-Client-IP: 98.145.187.19
Location: https://www.wut.com/
Content-Length: 0
Connection: close
-bash-4.1$

2.2.2

-bash-4.1$ get-any www.doesntexist.com /index.html -F

This command will provoke get-any to open a connection to www.doesntexist.com on port 80 and attempt to retrieve the resource /index.html. The get-any command will then display whatever the result of the HTTP GET is to the computer screen, will then display a line of the form "get-any: F:" and will then display a frequency count of all bytes that were contained in the data that was retrieved. This frequency count is of the form

    value=count
    value=count
    value=count
    ...

and is listed in descending order based upon the count field. An example of what might appear as a result of using this command is shown below.

-bash-4.1$ get-any www.freqfreq.org /public.html -F
HTTP/1.1 301 Moved Permanently


get-any: F:
1=3
e=3
P=2
T=2
...
-bash-4.1$

2.2.3

-bash-4.1$ get-any www.memecenter.com /index.html -I

This command will provoke get-any to open a connection to www.memecenter.com on port 80 and attempt to retrieve the resource /index.html. The get-any command will then display whatever the result of the HTTP GET is to the computer screen, will then display a line of the form "get-any: I:" and will then display the inverted data to the computer screen. An example of what might appear as a result of using this command is shown below.

-bash-4.1$ get-any www.memecenter.com /index.html -I
HTTP/1.1 301 Moved Permanently
get-any: I:
yltntenamreb dev0M 103 1.1/PTTH
-bash-4.1$

2.2.4

-bash-4.1$ get-any www.sortsort.net /index -S

This command will provoke get-any to open a connection to www.sortsort.net on port 80 and attempt to retrieve the resource /index. The get-any command will then display whatever the result of the HTTP GET is to the computer screen, will then display a line of the form "get-any: S:" and will then display the sorted data to the computer screen. An example of what might appear as a result of using this command is shown below.

-bash-4.1$ get-any www.sortsort.com /index.html -S
HTTP/1.1 301 Moved Permanently
get-any: S:
.
.-/01113HMPPTTadeeelmnortvy
-bash-4.1$
3 Submitting Your Program

You must submit your program using cscheckin. You must create and submit a Makefile with your source code. This Makefile will be used to build your program. Please place your code files and Makefile in a tar archive named hw5.tar. Please do not compress your program using zip, gzip, winzip, winrar, or any other compression tool before or after making a tar archive for submission. When you have finished testing your program, please use cscheckin to submit the hw5.tar file to your instructor.

4 Grading

You must do your own work for this assignment. This is not a “team programming” exercise. All code submitted for this assignment must be entirely your own. Your program will be evaluated for completeness, clarity, efficiency, and compliance with the specified requirements. Please ensure that you comment your code and include your name and course information in at least one comment at the top of the file in which your main function appears. Something like this would be nice:

/*
 * Your Name
 * CS 270
 * Homework 5
 * The date
 */