# CSSE2310: 2013 ‘Practice’ exam answers

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**Q1) Write shell commands to do the following:**

**A) Delete all files with names beginning with A and ending in .c**

rm A\*.c

**B) Show all lines in the file stuff which start with W**

grep ^W stuff

**C) A file nums consists of 4 space separated columns. Output columns 1, 3, 4 sorted by the last column**

cut -d ‘ ‘ -f1,3,4 nums | sort -k 3

OR

sort -k 4 nums | cut -d’ ‘ -f1,3,4

OR

cat nums | cut -d’ ‘ -f1,3,4 | sort -k 3

**D) Create a file c.c which is a copy of b.c**

cp b.c c.c

**E) For files f1, f2, f3, show all lines from any of them which contains all the words “song”, “river” and “terrible”**

cat f1 f2 f3 | grep song | grep river | grep terrible

**Q2) Write C to declare foo as:**

**A) An array of 12 integers**

int foo[12];

**B) A pointer to a positive integer**

unsigned int\* foo;

**C) Another name for a small integer**

typedef short foo;

**D) A struct containing an integer called i and a string called s**

struct {

int i;

char\* s;

} foo;

**NOTE: As question says a ‘struct’, it should be an instance of a struct, so foo goes at the end.**

**E) A pointer to a function which takes two floating point values and returns a string**

char\* (\*foo)(float, float);

**Q3)**



**A.** 2

**B.** 4 7

**C.** 3 6

**D.** 17

**E.** 9

**F.** 4 6

**G.** 8 2

**H.** 28

**I.** 8 9

**J.** 4 3 3 5

**K.** w ld

**Q4) A system has 32bit virtual address, 4KB pages and page table entries are 4Bytes. It uses a two level page table.**

**A. Which pages do the following (decimal) addresses belong to?**

**11111, 22222, 9001, 404040**

2, 5, 2, 98

Eg.

4096 bytes in a page

Page = virtual address / page size

Page = 11111/4096 = 2.7

This means virtual address 11111 is on Page 2 (which is the third page, since numbering starts at 0).

**B. what causes page faults?**

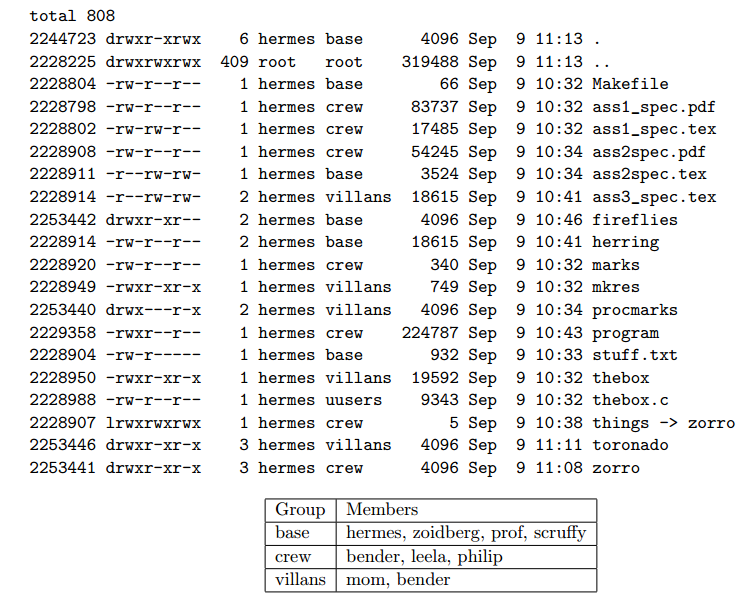
When an object/process/program is on disk and not in memory.

**C. What causes segmentation faults?**

-trying to access an invalid memory page

-writing to a read only page

**Q5) Consider the following directory listing:**

****

**A) what can zoidberg do to the following:**

**>stuff.txt**

read

**>procmarks**

read, execute

**B) Which users can modify all of the .tex files (without changing permissions)?**

the crew (bender, leela, philip)

**C)What command(s) could mom type to execute program?**

Copy program to home directory and then run it (mom can read program)

cp program ~/program

~/program

**D) What would change in the directory listing after hermes executed rmdir toronado (and why?)**

No change, since toronado is not an empty directory. rmdir does nothing.

**E) What command was used to create things?**

ln -s zorro things

**F) Given the following commands and their output:**

**prompt> ls -l zorro/transport**

**lrwxrwxrwx 1 hermes base 21 Sep 9 11:20 zorro/transport -> ../fireflies/serenity**

**prompt> ls -l fireflies/serenity**

**-rwx--x--x 1 hermes base 1072966 Sep 9 10:46 fireflies/serenity**

**Can bender run ./things/transport ? (Why?)**

No because the fireflies directory doesn’t give bender permissions to execute it (in other words access stuff in the folder)

**Q6) Network stuff**

**A)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Network Address** | **Subnet Mask** | **Broadcast Address** |
| **X1** | 10.10.96.0 | 255.255.254.0 | 10.10.97.255 |
| **X3** | 10.10.144.0 | 255.255.248.0 | 10.10.151.255 |
| **X4** | 10.11.64.32  ~~10.11.64.40.0~~ | 255.255.255.240  ~~Shouldn’t this be 255.255.252 since only the last three bits differ?~~ | 10.11.64.47  ~~10.11.64.40.3~~ |

**B) What does the bind() function perform?**

bind(): After a socket has been created, it attaches a local address to it.

**C) X2 performs NAT for this network. What is NAT and why is it necessary?**

Network address translation: Needed when the number of IPs assigned to you is less than the total number of computers trying to access the internet. It assigns an entity/organisation a single IP

Wouldn’t a safer answer be that some IPs are non -routable (<http://jeff.nieusma.com/docs/network/non-routable-ip.html>). If any machines with these IPs want to communicate with the rest of the internet, their address must be converted by the NAT.

**D) to which layers do the following belong:**

|  |  |
| --- | --- |
| **Term** | **Layer** |
| **MAC address** | link |
| **socket** | application <- should this be transport? |
| **IP Address** | network |
| **port** | transport |
| **UDP** | transport |
| **URL** | application |

**E) What is the purpose of a network gateway?**

Router interface connected to the local network. It’s purpose is to send packets out of and receive to the local network.

Isn’t the actual question **E) What is the purpose of a gateway address?**? Would that be the same answer? Or just to receive packets from the local network and send them outward, since the gateway address is technically only the internal-facing interface?

**Q7) Consider a “unix" filesystem where:**

**>i-nodes have 10-direct pointers, 1 indirect pointer and 1 double indirect pointer.**

**>Blocks are 8KB**

**>Block pointers are 4Bytes**

**>blocks are numbered from 0.**

**A)Why is fragmentation a problem for linked filesystems but not for indexed filesystems?**

Indexed filesystems are sequential so adjacent blocks store data “in order”. Linked filesystems hold pointers to data, so the data can be spread (physically) across the disk.

**B) How many blocks (in total) must be accessed to read the following blocks from a file: 9, 2053, 2057**

1 for 9, 2 for 2053, and 1 for 2057 (the pointer is stored from the 2053 read)

total of 4

**C)What is the maximum possible file size for this file system?**

total size = (10\*8192) + (1\*2048\*8192) + (1\*2048^2 \* 8192) = 33,570,896 kB

**D) If an additional 2 double indirect pointers were added to the i-nodes on this system, what would be the increase in maximum file size?**

Increase is 2\*2048^2 \* 8192 = 67,108,864 kB

**Question 8: multiprocess/fork stuff**

**A)**

**Lower diagram shows a process being reaped by a process who isn’t its parent (or init). This is impossible.**

**B)**

**~~wait(), with WNOHANG set.~~**

**waitpid();**

**C)**

**kill(pid\_t pid, int sig)**

**D)**

**pthread\_exit(void\* value\_ptr)**

**pthread\_join(pthread\_t thread, void\*\* value\_ptr)**

**E)**

**pthread\_mutex\_lock**

**pthread\_mutex\_unlock**

**F)**

**~~The down arrow indicates reaping of the child. So the top left, top right and bottom right are possible but not bottom left, for the same reason as (A).~~**

**JEA: Down arrow indicates a thread being joined. All of them are possible. Threads do not follow the same rules as processes, because they are different.**

**Isn’t it that a thread cannot join a thread who isn’t its child? So the bottom left is not correct**

**Threads can join any other thread if they know the thread id.**

**Question 9) code**

**Note: As the question states, the #includes aren’t necessary in your answer. I put them in so I could run the code. Copy/Paste all 5 functions and play around with it for fun.**

#include <stdio.h>

#include <stdlib.h>

#include <string.h>

#include <stdbool.h>

#include <unistd.h>

#include <sys/types.h>

#include <sys/wait.h>

bool matchingLines(const char\* string, const char\* filename) {

FILE \*file;

char line[81];

if ((file = fopen(filename, "r")) == NULL) {

return false;

}

while(fgets(line, 81, file) != NULL) {

if (strstr(line, string) != NULL) {

printf("%s", line);

}

}

return true;

}

**B)**

bool grepSearch(const char\* string, const char\* filename) {

if (fork()) { /\* Parent \*/

int status;

wait(&status);

if (WIFEXITED(status)) {

if (WEXITSTATUS(status) == 2) {

return false;

} else {

return true;

}

}

} else { /\* Child \*/

execlp("grep", "grep", string, filename, NULL);

exit(0);

}

return true;

}

**C)**

bool matchingLinesMany(const char\* string, const char\*\* filenames, int numfiles) {

int i = 0;

int status;

bool result = true;

for(i = 0; i < numfiles; i++) {

if (fork() == 0) {/\* Child \*/

if (matchingLines(string, filenames[i])) {

exit(0);

} else {

exit(2);

}

}

}

for(i = 0; i < numfiles; i++) {

wait(&status);

if (WIFEXITED(status)) {

if (WEXITSTATUS(status) == 2) {

result = false;

}

}

}

return result;

}

With threads (see next page):

struct SearchData {

char \*string;

char \*filename;

};

void\* match(void\* arg) {

struct SearchData\* data = (struct SearchData\*) arg;

bool res = matchingLines(data->string, data->filename);

pthread\_exit((void\*) res);

}

bool matchingLinesMany(const char\* string, const char\*\* filenames, int numfiles) {

pthread\_t\* threads = malloc(numfiles \* sizeof(pthread\_t));

struct SearchData\* searches = malloc(numfiles \* sizeof(SearchData));

bool result = true;

for (int i = 0; i < numfiles; ++i) {

searches[i] = malloc(sizeof(struct SearchData));

data->string = string;

data->filename = filenames[i];

pthread\_create(&threads[i], NULL, match, (void\*) data);

}

for (int i = 0; i < numfiles; ++i) {

bool res;

pthread\_join(threads[i], (void\*\*) &res);

if (!res) {

result = false;

}

free(threads[i]);

free(searches[i]);

}

return result;

}

**D)**

bool grepSearchMany(const char\* string, const char\*\* filenames, int numfiles) {

int i = 0;

int status;

bool result = true;

for(i = 0; i < numfiles; i++) {

if (fork() == 0) { /\* Child \*/

execlp("grep", "grep", string, filenames[i], NULL);

//should this line not be

result = grepsearch(string, filenames[i]);

exit(result);

exit(0);

}

}

for(i = 0; i < numfiles; i++) {

wait(&status);

if (WIFEXITED(status)) {

if (WEXITSTATUS(status) == 2) {

result = false;

}

}

}

return result;

}

**E)**

int main(int argc, const char \*\*argv) {

if (argc < 4 || ((strcmp(argv[1], "M") != 0) &&

(strcmp(argv[1], "G") != 0))) {

fprintf(stderr, "Bad params.\n");

exit(1);

}

int i = 0;

int (\*func)(char\*, char\*, int); // function pointer avoids code duplication

if (argv[1][0] == 'M') {

func = matchingLinesMany;

} else {

func = grepSearchMany;

}

if (!func(argv[2], argv+3, argc - 3)) {

fprintf(stderr, "Bad file.\n");

exit(2);

}

return 0;

}