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## CS35L: Software Construction Laboratory

Winter 2018  
Lab 7

### Final Exam

March 22, 2018 11:30 AM – 2:30 PM

100 Points (50% of Final Grade)

#### Instructions:

1. Please write your response clearly in the allotted space. Unreadable answers will not be graded. You may also use the back side of every page to record your answers for the questions given on that page.
2. Use the extra pages attached towards the end for rough work.
3. If you have any questions, raise your hand and the TA will come to you to clarify the question.
4. If you need to assume anything which is beyond what is stated in the questions, please write your assumption and the corresponding solution. However, your assumption should not contradict the question itself.
5. There will be partial credits for every problem.
6. Please refrain from cheating.
7. Using cell phone during the exam is prohibited.





Q1 (5 points)

Command 1: echo I am a good boy | tr 'good' 'test'

Command 2: echo I am a good boy | sed 's/good/best/g'

What will each of these commands output? Explain how you got it.

1. I am a test boy
2. I am a best boy

✓ sed will replace strings  
g does it globally.

The tr command translates bytes, the equivalent from string 1 to string 2  
g → t  
o → e & o → s overwrites  
a → t o → e

Q2 (8 points)

Write a python function which takes three strings as input – 'source', 'destination', 'mystring' and implements substitution.

[Replace source characters of 'mystring' to destination characters]

Example:

Input: 'abc', 'def', 'mystringabcdef'

Output: 'mystringdefdef'

def main():

source = args[0]

destination = args[1]

mystring = args[2]

for i in mystring

for j in source

if (mystring[i] == source[j])

mystring[i] = dest[j]

print mystring

if \_\_name\_\_ == "\_\_main\_\_":

main()

I assume source and dest are same length

also no repeats in source 😊



Q3 (6 points)

Write a bash script which does the following:

1. Copies all the files of the current directory into a new folder called 'mylab' (which should be in the same directory).
2. Creates a new file called 'new\_file.txt' inside the 'mylab' directory with text 'CS 35L Final Exam'.
3. Appends a line to the new\_file.txt – this line would be the name of the first file you obtain after sorting the filenames inside the 'mylab' directory in ascending order.

```
#!/bin/bash
mkdir mylab
RESULT='find . -type f'
for FILE in $RESULT
do
    cp $FILE mylab/$FILE
done
touch mylab/new_file.txt
cat "CS 35L Final Exam" >> mylab/new_file.txt
touch temp2
touch temp
ls -a mylab >> temp
cat temp | sort >> temp2
head -n 1 temp2 >> mylab/new_file.txt
rm -f temp
rm -f temp2
```



6

Q4 (6 points)

In a galaxy far far away there lived a Darth Cipher. DC wants to send some information to Earth (Message to be sent from DC to E) using asymmetric encryption (Public and Private key). Darth Cipher would like to request you for help on Twitter. In less than 140 characters explain to him:

- a. For broadcasting the message, whose key will be used to encrypt the message to ensure that the broadcasted message is not tampered/rewritten.

DC will use his private key to make message digest and encrypt

- b. For one-to-one secure communication (DC wants to send the message to E), whose key will be used to encrypt and decrypt the message to ensure no third-party is able to read the message.

DC uses E's public key to encrypt  
E uses his private key to decrypt

3

Q5 (3 points)

How do you search for a keyword within the man page? Does the search in the man page support regular expressions? If yes, give an example.

/ [keyword]

yes.

/ 'a'





3

Q6 (4 points)

Does the following code throw any error? If yes, then what error?

Debug this code and write the correct solution (the correct solution may include inserting/deleting some lines in the given code). Also write the gdb commands you would try to debug this code.

```

1. #include<stdio.h>
2.
3. struct node{
4.     int val;
5.     struct node *up;
6.     struct node *down;
7. };
8.
9. struct stack {
10.    struct node *root;
11. };
12.
13. typedef struct stack stack_set;
14.
15. int main(){
16.    stack_set *set;
17.    set = malloc(sizeof(stack_set));
18.    set->root = NULL;
19.    set = malloc(sizeof(struct node));
20.    set->root->val = 0;
21.    printf("%d", set->root->val);
22.    return 0;
23. }

```

Yes.

segmentation fault ✓

gdb commands:

break 15  
run  
next  
step  
list  
info frame ✓

19. set = malloc(sizeof(struct node));

→ root



2 Q7 (7 points)

The 'last' shell command shows all the users logged into the system for the last 30 days. Which user logged in the highest number of times in the last 30 days? Write a shell script you will use to get the result.

```
last | awk -F '{print $1}' | sort -n > temp3  
cat head -n 1 < temp3  
rm temp3
```

9. Q8 (9 points)

a) Input file (3 points)  
file.txt:

apple  
orange  
mango  
apple  
grapes  
mango  
apple  
orange  
orange  
apple

3

Task: to count each item

Hint: `uniq -c` counts the items using some order of the input

Command: `cat file.txt | sort | uniq -c`

b) (2 points)

a. I forgot the last few commands I ran, which 'shell command' do I use to see them?

history ✓

b. Without using the above 'shell command', how do I run the previously ran shell command which starts with letter 'g'?

!g ✓

c) What is the maximum length for a filename under Linux? (1 point)

128 characters ✗



d) What are the kinds of permissions/modes under Linux? (1.5 points)

full readwrite read/execute read/only  
none

write and execute  
write only  
execute only

e) What does chmod g+rx do? (1.5 points)

adds read and execute permissions to the group class

f) What is the ssh port number? (1 point)

a number identifying which connection port to use. For example, lnxsv07.seas.ucla.edu uses

port 22

to connect, the port # is which channel is used to transmit data through.

25

Q9 (3 points)

Which shell command will you use to copy a file securely from your home directory on the lnxsv09.seas.ucla.edu to your local machine? (Write the full command; assume your SEASnet account username on the lnxsv09.seas.ucla.edu is 'user0').

scp user0@lnxsv09.seas.ucla.edu /HOME/file /usr/danics/Desktop/new\_file

My local machine runs Windows so I would use WinSCP. I cannot use a shell command to transfer it...

Q10 (3 points)

a. The GDB command "info local"

- A) displays the list of local variables
- B) value of local values for the current stack frame
- C) displays the list of local variables & value of local values for the current stack frame
- D) none of the mentioned

2

b. 'Make' keeps track of when files were last compiled and only recompiles those target files for which source files were changed since make was last executed.

- A) True
- B) False

c. If make command is executed as "make -j 2", then

- A) two jobs will run simultaneously
- B) only two will be executed
- C) it will give an error
- D) none of the mentioned

X



Q11 (3 points)

Patching -

Why not just change the original source code to fix it? Why do we have patches?

Without patches, every time you wanted to change part of software you would have to reinstall an entire file, which may be slow. With patches, you can download a smaller file to fix things.

Q12 (4 points)

List two differences between Softlink and Hardlink.

(relative or absolute)  
Softlinks point to the path of the file  
Hardlinks point to the same inode of a file

If a file pointed to by a softlink is changed, the softlink changes as well

Deleting the file pointed to by a softlink deletes it entirely.

If you delete a file pointed to by a hardlink, the hardlink will still have the file's data.





9

Q13 (9 points)

- a. Write a bash script to swap two numbers without using the third variable. The two numbers should be taken as input from the command line. (5 points)

```
#!/bin/bash
```

```
a=$1
```

```
b=$2
```

```
b=$a
```

```
a=$b
```

5

- b. Assume you created the above bash script file inside the git repository on your computer. Write down the command(s) you will use to add this file to the remote git server. (Hint: There are 3 main commands) (2 points)

```
git add <filename>
```

```
git commit
```

```
git push origin
```

use origin if it's a new branch

- c. Write the command to create a new branch called mybranch and then switch to it. Write down the command(s) you use to perform the above operations (2 points)

```
git branch mybranch
```

```
git checkout mybranch
```



Q14 (3 points)

User 1: Play Spotify

Prompt: Permission denied

User 1: su root. Play Spotify

Prompt: Okay

The 'su root' command allows the User 1 to become the root user of the system. What is a root user on any unix-like operating system? How is the root user different from other users?

root user is a "superuser". As root, <sup>user</sup> you can su to switch to any user without a password. That user has full permissions on the computer.

Q15 (4 points)

Give the keystrokes for Emacs commands:

a. Copy a region

C-Y

b. Paste

C-P

c. Replace

C-R

d. Undo

C-X C-U

C-X R

Q16 (3 points)

a. Write a shell command to create a directory 'finals' and 'submission' inside finals without using mkdir twice. (1 point)

mkdir -p finals/submission

b. Write the shell command to find all html files in the current directory whose name starts with letter 'a' and ends with a digit followed by a '#' (1 point)

find . -name 'a.\*([0-9]#)\$'

c. Write a shell command to replace the character '/' with ',' in a file in-place? (Hint: sed) (1 point)

sed 's|/|/,|g'



2 3 Q1 Answer the following questions (4 points)

a. Define 'critical section'. (1.5 point)

The part of code that is parallelized.

b. Fill the blanks in the following program: (2.5 points)

```
#include<stdio.h>
#include<stdlib.h>
#include <pthread.h>

void *printMsg(void *thread_num) {
    int t_num = (int) thread_num;
    printf("It's me, thread #%%d!\n", t_num); }

int main() {
    pthread_t tids[3];
    int t;
    for(t=0; t<3; t++) {
        int ret = pthread_create(&tids[t], NULL, printMsg, (void *) t);
        if(ret) {
            printf("Error creating thread. Error code is %%d\n", ret);
            exit(1);
        }
    }

    for (t=0; t<3;t++) {
        int ret1 = pthread_join(&tids[t], NULL);
        if(ret1) {
            printf("Error joining thread. Error code is %%d\n", ret1);
            exit(1);
        }
    }
}
```



4

Q18 (4 points)

\_\_\_\_\_ provide(s) an interface to the services provided by an operating system. (1 point)

- A) Shared memory
- B) System calls
- C) Simulators
- D) Communication

b. System calls can be run in either user mode or kernel mode. (1 point)

- A) True
- B) False

c. List the compilation steps of a GCC compiler (2 points)

pre-processing  
 compilation  
 assembler  
 linking

3

Q19 How are libraries dynamically loaded? What are two advantages and one disadvantage of dynamic linking? (4 points)

They are loaded with a symbol and relocation table. Libraries are placed under a program's control, and the program selectively calls functions within the library.

Advantages:

1. A single library can be shared among multiple programs.
2. When shared libraries are updated, executables that use them don't need to be updated.

This saves memory

Disadvantage: Hurts performance to have to load shared objects.

Q20 Unbuffered vs buffered I/O. Which is faster in what applications - when would you use buffered or unbuffered I/O? (2 points)

15

Buffered: Reading in large chunks of data at once. You would use it when you need to access other local data. For example, it is faster to use buffered when reading from a hard drive.

system calls

You would use unbuffered if you only want to read/write each byte individually. Each byte is read/written by the kernel through a system call. If you don't want other local bytes to be read or written, use unbuffered. Talking in many other bytes in a buffer could use up space in a cache that is not needed.





Q21 (9 points)

9

a. Which shell command is used to display the unix version (1 point)

- A) `uname -r`
- B) `uname -n`
- C) `uname -t`
- D) `kernel`

b. What would be the current working directory at the end of the following command sequence? (1 point)

```
$ pwd
/home/user1/proj
$ cd src
$ cd generic
$ cd .
$ pwd
```

`/home/user1/proj/src/generic`

c. Which of these is NOT a valid variable in bash (1 point)

- A) `__` (double underscore)
- B) `_1var` (underscore 1 var)
- C) `_var_` (underscore var underscore)
- D) `some-var` (some hyphen var)

d. What is the output of this program? (3 points)

```
#include<stdio.h>
#include<pthread.h>
#include<fcntl.h>

void *fun_t(void *arg);
void *fun_t(void *arg)
{
    pthread_exit("Bye");
    printf("CS35L\n");
}
int main()
{
    pthread_t pt;
    void *res_t;
    if(pthread_create(&pt,NULL,fun_t,NULL) != 0)
        perror("pthread_create");
    if(pthread_join(pt,&res_t) != 0)
        perror("pthread_join");
    printf("%s\n",(char *)res_t);
    return 0;
}
```

- A) CS35L
- B) Bye
- C) segmentation fault
- D) run time error
- E) 0



e. In Linux, the static libraries can be created by (1 point)

- A) ar command
- B) as command
- C) ap command
- D) aq command



f. What does the 'strace' command do? (2 points)

intercepts and prints

system calls to stderr  
or an output file





**Name:** \_\_\_\_\_ **UID:** \_\_\_\_\_

*(Space for rough work)*



**Name:** \_\_\_\_\_ **UID:** \_\_\_\_\_

*(Space for rough work)*

