Exam questions

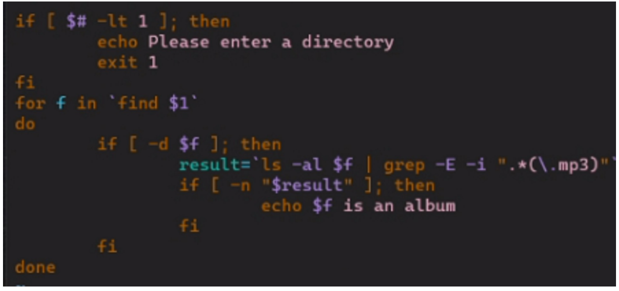
Tuesday, 8 June 2021 00:11

1. Display lines in a.txt that contain at least 1 timestamp (hh:mm:ss:sss).
   grep -E -i "^.*(([0-9]{2}:){3}[0-9]{3})+.*" a.txt

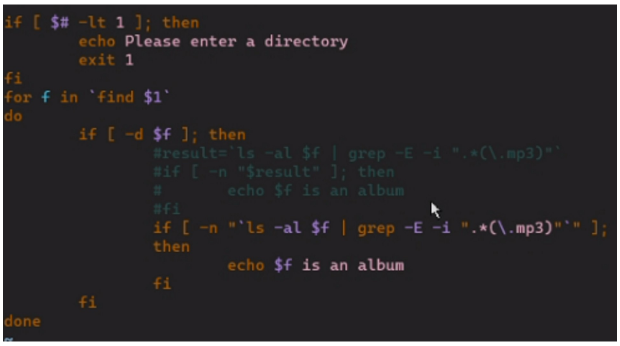
2. Display lines of file a.txt by swaping any pairs of vowel followed by odd digit (a23b7a98i3 -> a23b79a83i).
   sed -E "s/([aeiou])([13579])/\2\1/gi" a.txt

3. Display a list of all unique appearances of number Pi with 2 or more decimals in a.txt.
   grep -E -i -o "(3\.14[0-9]*)" a.txt | sort | uniq

4. Given a directory and its hierarchy, write a UNIX Shell command that shows all the albums in it. An album is a directory containing files with the extension ".mp3".

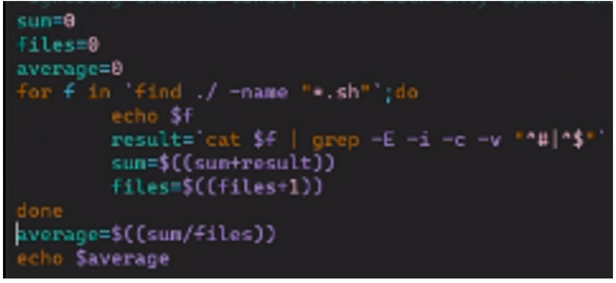


```
if [ $# -lt 1 ]; then
        echo Please enter a directory
        exit 1
fi
for f in `find $1`
do
        if [ -d $f ]; then
                result=`ls -al $f | grep -E -i ".*(\.mp3)"`
                if [ -n "$result" ]; then
                        echo $f is an album
                fi
        fi
done
```

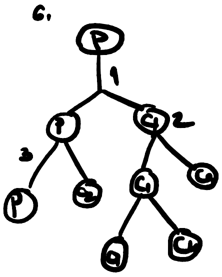


```
if [ $# -lt 1 ]; then
        echo Please enter a directory
        exit 1
fi
for f in `find $1`
do
        if [ -d $f ]; then
                #result=`ls -al $f | grep -E -i ".*(\.mp3)"`
                #if [ -n "$result" ]; then
                #       echo $f is an album
                #fi
                if [ -n "`ls -al $f | grep -E -i ".*(\.mp3)"`" ];
                then
                        echo $f is an album
                fi
        fi
done
```

5. Write a UNIX Shell script that calculates the average number of lines of code in all files with extension ".sh" in the current directory, ignoring comment lines, lines with only spaces and tabs.



```
sum=0
files=0
average=0
for f in `find ./ -name "*.sh"`;do
        echo $f
        result=`cat $f | grep -E -i -c -v "^#|^$"`
        sum=$((sum+result))
        files=$((files+1))
done
average=$((sum/files))
echo $average
```



6. How many processes are created?

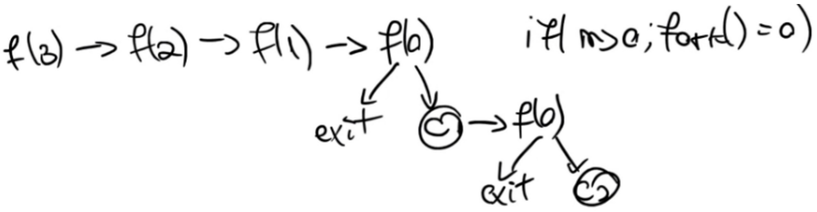
```
if (fork() || fork() ) {
    1        2
        fork();
         3
}
```

   4

7. How many processes are created when the parent process calls f(3)?

```
void f(int n) {
        if (n > 0 || fork() == 0) {
                f(n-1);
                exit(0);
        }
        wait(0);
}
```

   Infinite



8. What will the code bellow print?

```
char * s[3] = {"A", "B", "C"};
for  (i = 0; i < 3; i++) {
        if (fork() == 0) {
                execl("/bin/echo", "/bin/echo", s[i], NULL);
        }
}
```

Printeaza A B C, dar in ordine aleatorie.

9. What does the system call "read" do when the pipe contains less data then it is required to read, but it is not empty?
Citeste cat poate.

10. What will the code print?

```
int p[2];
char buf[10];
int n;
pipe(p);
n = read(p[0], buf, 10);
printf("%d \n", n);
```

Se va bloca deoarece pipe-urile de scriere nu au fost inchise si read va astepta date de la un scriitor inexistent.
Daca se presupune ca pipe-ul de scriere este inchis, va printa 0.

11. Why is a zombie process a problem?
Ocupa PIDs si sistemul se va bloca pentru ca nu vor mai fi PIDs disponibile.

12. f is executed simultaneously by 10 threads. Add the necessary code to ensure n is 10 after threads have completed.

```
int n = 0;
pthread_mutex_t m=PTHREAD_MUTEX_INITIALIZER;
void * f(void * p) {
        pthread_mutex_lock(&m);
        n++;
        pthread_mutex_unlock(&m);
        return NULL;
}
```

13. Schedule the activities so that the sum of delays is minimum: A/7/13, B/5/9, C/2/4.
-Job, Length, Deadline

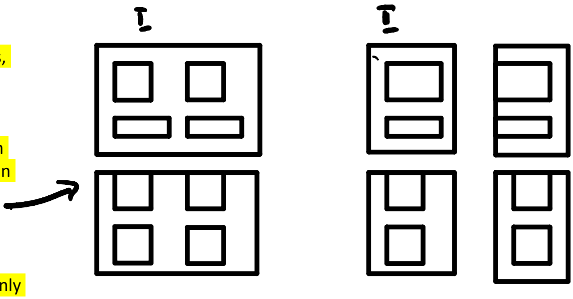
A	7	13
B	5	9
C	2	4

CBA

14. Write an advantage and a disadvantage of the set-associative caches vs. the direct caches.
A: Set-associative is faster because the replacement policy is applied rarely, sanse mult mai mici de cache thrashing.
D:If 2 adresses of 2 blocks with the same slot are solicited in direct caches, the eficiency of the sistem decreases, nu toata memoria disponibila este folosita.

15. What page has the highest priority in the LRU replacement policy, when choosing a victim page.
The page that has the least amount of solicitations. If we use the access counter: the victim page is the one with the smallest counter. If we use the reference matrix: the victim page is the number of the line with the least 1 on it.

16. Given 2 set-associative caches, one with 2 sets of 4 pages and one with 4 sets of 2 pages, which would perform better for the following sequence of page requests: 20, 9, 18, 27, 20, 9, 18, 27.
For the set-associative cache with 2 sets of 4 pages there are a lot of collisions because the remainder can be only 0 or 1 and so, only the pages 0 and 1 will be considered.
The one with 4 sets of 2 pages will perform better because the collisions don't happen so often.



SLOT 0: 20 18 20 18
SLOT 1: 9 27 9 27

SLOT 0: 20 20
SLOT 1: 9 9
SLOT 2: 18 18
SLOT 3: 24 27

17. How many data blocks can be referenced to by the triple-indirection of an i-node, if a block contains N addresses to other blocks?
N^3

18. Consumer-producer with buffer N -> semaphores.
2 semaphores with initial values 0, N and one that has the value 0 or 1:
1 indicates the number of occupied positions
1 inidicates the number of empty positions
1 ensures the exclusive access to the buffer when it is modified

19. Method for preventing deadlock when you cannot avoid modifying resources concurrently.
choose an order for your resources (any order) and always lock them in the same order

20. Binary semaphore and its P method.
A binary semaphore is restricted to values of 0 and one and can be used to control access to a single source, in particular enforce mutual exclusion for a critical section in user code
P: If the semaphore is unlocked, it becomes locked and the call returns, allowing the thread to continue. If the semaphore is locked, the thread is blocked and placed in a queue Q of waiting threads

21. Write a UNIX command which prints all the lines in the file a.txt that contain at least a binary number that is a multiple of 4 with 5 or more digits. (ex: 010100).

```
grep -E -i "[01]{3,}[0]{2}" a.txt
```

22. Write a UNIX command which inverts all the pairs that contains an odd digit followed by a vowel. (a23e8i97u3 -> a2e38i9u73).

```
sed -E "s/([13579])([aeiou])/\2\1/gi" a.txt
```

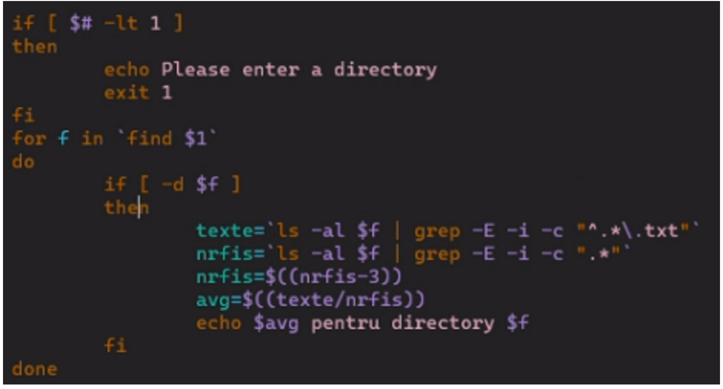
23. Write a UNIX command which prints all the unique football scores (ex: 4 - 0) which appear in a.txt. The number of goals may have at most 2 digits.

```
grep -E -i "[1-9][0-9]?-[1-9][0-9]?" a.txt | sort | uniq
```

24. Print the number of processes of every active user in the system.

```
ps -ef | tail -n+2 | awk -F" " '{print $1}' | sort | uniq -c
```

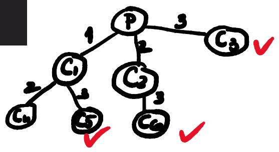
25. Write a UNIX Shell script which computes the average of files with the extension ".txt" per directory from the current directory and all its subdirectories.



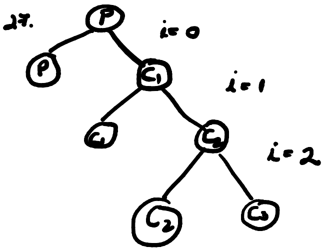
```
if [ $# -lt 1 ]
then
        echo Please enter a directory
        exit 1
fi
for f in `find $1`
do
        if [ -d $f ]
        then
                texte=`ls -al $f | grep -E -i -c "^.*\.txt"`
                nrfis=`ls -al $f | grep -E -i -c ".*"`
                nrfis=$((nrfis-3))
                avg=$((texte/nrfis))
                echo $avg pentru directory $f
        fi
done
```

26. How many processes will the code fragment bellow create, excluding the parent process?

```
if (fork() != fork()) {
   1    fork();   2
}       3
```



6 fara parent



27. Draw the hierarchy of processes generated by the following code:

```
int p = 0;
for (i = 0; i < 3; i++) {
        if (p == 0)
                p = fork();
        else
                wait(0);
}
```

28. What does the system call "write" do when in the PIPE there is space, but not enough for how much it is asked to write?

Scrie cat permite spatiul.

29. What does the following code print if no other process opens the "abc" FIFO? Justify.

```
int r, n, k=10;
r = open("abc", O_WRONLY);
n = write(r, &k, sizeof(int));
printf("%d\n", n);
```

se va bloca deoarce nu este deschis complementar si va astepta sa fie deschis pentru read.

30. What happens with the zombie processes of a parent which terminates/ends?

Daca parentul apeleaza wait vor fi ucise; daca nu, vor ramane in lista proceselor pana vor fi ucise.

31. Schedule the execution of the following jobs such that the sum of the delays is minimum:

A/22/27, B/2/15, C/4/5

-Job, Length, Deadline

A	22	27
B	2	15
C	4	5

CBA - delay 1

32. What category of pages from the memory has the highest priority from which the NRU policy of replacement would choose a victim page?

The class 0, in which pages are not referenced and not modifies.

33. What would you add to the following code fragment so that it will print "1 3 3"? The changes can't eliminate from the execution the original lines of code.

```
int n = 0;
pthread_mutex_t m[3];
void * f(void * p) {
        int id = (int) p;
        pthread_mutex_lock(&m[id]);
        n += id;
        printf("%d ", n);
        pthread_mutex_unlock(&m[(id+1) % 3]);
        return NULL;
}
int main() {
        int i;
        pthread_t t[3];
        for (i=0; i<3; i++) {
                pthread_mutex_init(&m[i], NULL);
        }
        pthread_mutex_lock(&m[0]);
        pthread_mutex_lock(&m[2]);
        for (i=0;i<3;i++) {
                pthread_create(&t[i], NULL, f, (void*)i);
        }
        for(i=0;i<3;i++) {
                pthread_join(t[i], NULL);
        }
        for(i=0;i<3;i++) {
                pthread_mutex_destroy(&m[i]);
        }
        return 0;
}
```

34. How many blocks of data can be referenced by a triple-indirection of an i-node, if a block has dimension B and an address has dimension A?
(B/A)^3

35. What happens to a hard link if the file that it points to is deleted?
It keeps the data of the deleted file even if the file does not exist anymore.

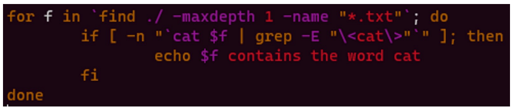
36. Write a UNIX Shell command that displays the lines in file a.txt that contains words starting with capital letters.
grep -E "\<[A-Z].*\>" a.txt

37. Write a UNIX Shell command that inverts in file a.txt all pairs of neighboring digits. (ex: a3972b -> a9327b).
sed -E "s/([0-9])([0-9])/\2\1/gi" a.txt

38. File a.txt contains on each line two numbers separated by space. Write a UNIX Shell command that displays for each line the sum of its numbers.
awk -F" " '{print $1 + $2}' a.txt

39. Display only the lines of a file a.txt that appear only once (not duplicated).
cat a.txt | sort | uniq -u

40. Write a UNIX Shell script that displays the name of each .txt file in the current directory that contains the word "cat".

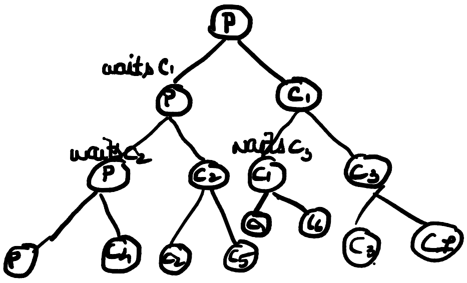


```
for f in `find ./ -maxdepth 1 -name "*.txt"`; do
        if [ -n "`cat $f | grep -E "\<cat\>"`" ]; then
                echo $f contains the word cat
        fi
done
```

41. In the program fragment below, mark which process executes each line: the Parent, the Child, or both.
P C

```
        k = fork(); Parent
        if (k == 0) {
                printf("A\n"); Child
        } else {
                printf("B\n"); Parent
        }
        printf("C\n"); Both
```

42. How many processes will be created by the code fragment below, excluding the initial parent process?
fork(); wait(0); fork(); wait(0); fork();
7



43. What are the possible console outputs of the following code fragment (ignoring any output that execl might generate), and when will it happen?
printf("A\n"); execl(...); printf("B\n");
If execl fails, it will print A and B.
If execl succeds, it will print only A because the current process image will be replace with a new one.

44. What does the system call "read" do when the pipe is empty?
It will return EOF if no process has the write end open and it will wait for some data to arrive to the pipe if there is a writer connected.

45. What does the system call "open" do before returning from opening a FIFO?
It waits until the opposing end of it is opened by another process.

46. Give a reason for choosing threads over processes.
Communication between threads is easier than between processes because of their shared data.

47. Considering the functions "fa" and "fb" are run in concurrent threads, what will the value of "n" be after the threads are finished? Why?

```
pthread_mutex_t a, b;
int n = 0;
void * fa(void * p) {
        pthread_mutex_lock(&a);
        n++;
        pthread_mutex_unlock(&a);
}
void * fb(void * p) {
        phtread_mutex_lock(&b);
        n++;
        pthread_mutex_unlock(&b);
}
```

We don't know the exact result because, by using two different mutexes, a thread can still access the critical resource and modify it when the other threads modifies it too.

48. Schedule the following jobs so that they all meet their deadlines: A/5/9, B/7/13, C/1/10.

Job	Duration	Deadline
A	5	9
B	7	13
C	1	10

ACB - no delay

49. Give one advantage and one disadvantage of the segmented allocation method over the paged allocation method.

D: The segmented method is slower than the paged method.
A: The segmented method allows for the sharing of the procedures.

50. When would you load into memory the pages of a program that is being started?
When they are solicited. In the moment of starting the execution it has no page in the memory.

51. When does a process change state from RUN to READY?
When another process that was in the WAIT state because of I/O operation finished and is brought back in the RUN state.

52. Given a UNIX file system configured with a block size of B bytes that can contain A addresses, and i-nodes having S direct link, one simple indirection link, one double indirection link and one triple indirection link, give the formula for the maximum file size possible.
S*B + A*B + A^2*B + A^3*B

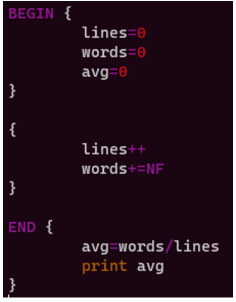
53. What happens with the data when you delete a file that has a hard link pointing to it?
The data will be kept by the hardlink, but it will be deleted from the original file.

54. Give a method for preventing deadlocks.
Choose an order for the resources and always lock them in the same order.

55. What is a binary semaphore, and what is the effect of its P method, when called by multiple concurrent processes/threads?
A binary semaphore is restricted to values of 0 and one and can be used to control access to a single source, in particular enforce mutual exclusion for a critical section in user code.
When called by multiple concurrent processes/threads, it will allow just one to enter the critical section.

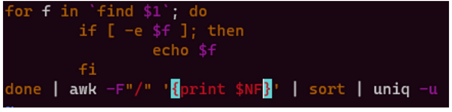
56. Write a UNIX Shell command that eliminates all non-letter characters from a file a.txt.
sed -E "s/[^a-z]//gi" a.txt

57. Write an AWK program that applied to a file containing words separated by spaces, calculates the average word count per line.



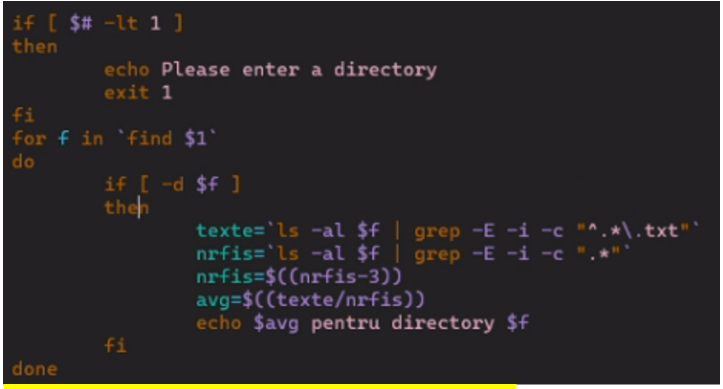
```
BEGIN {
        lines=0
        words=0
        avg=0
}

{
        lines++
        words+=NF
}

END {
        avg=words/lines
        print avg
}
```

58. Display all the unique file names (without the path) in a given directory and all its hierarchy of subdirectories.



```
for f in `find $1`; do
        if [ -e $f ]; then
                echo $f
        fi
done | awk -F"/" '{print $NF}' | sort | uniq -u
```

59. Write a UNIX shell script that calculates the average number of lines in all the files with the .txt extension in the current directory.



```
if [ $# -lt 1 ]
then
        echo Please enter a directory
        exit 1
fi
for f in `find $1`
do
        if [ -d $f ]
        then
                texte=`ls -al $f | grep -E -i -c "^.*\.txt"`
                nrfis=`ls -al $f | grep -E -i -c ".*"`
                nrfis=$((nrfis-3))
                avg=$((texte/nrfis))
                echo $avg pentru directory $f
        fi
done
```

Eliminate the check if it is a directory, avg done outside the for loop
the loop will be done with ls, check if it is a file then check its extension with a grep
number of lines is done by cat file | grep -c ".*", keep a variable for the number of files

60. What will the code fragment below print to the console, if no other process opens the "abc" FIFO? Justify.
int r, w, n = 0;
r = open("abc", O_RDONLY);
n++;
w = open("abc", W_WRONLY);
n++;
printf("%d\n", n);
The code will print nothing because it will be stuck at the first open waiting for another process to open the FIFO at the writing end.

61. What happens with a process between the moment it finishes and the moment its parent calls wait?
It will enter in a zombie state, not executing code, but occuping a PID. When running ps -ef it will be shown with a <defunc>.

62. Schedule the following jobs so that the sum of their delays is minimized: A/7/13, B/5/9, C/2/4.

Job	Duration	Deadline
A	7	13
B	5	9
C	2	4

CBA - delay 1

63. Give an advantage and a disadvantage of the set-associative caches vs. the associative caches.
A: Set-associative caches are a bit faster.
D:Smaller chances of cache thrashing.

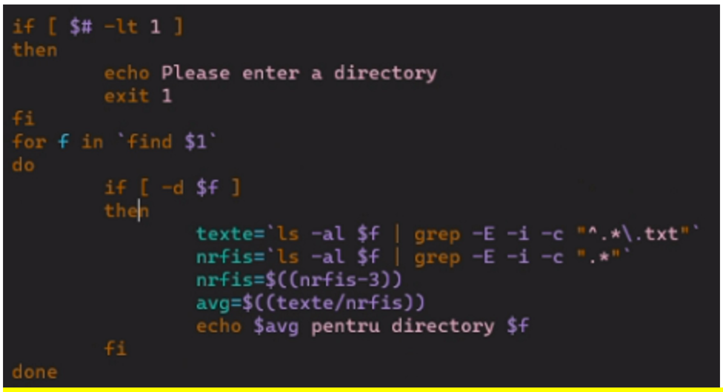
64. How many data blocks can be referenced to by the double-indirection of an i-node, if a block contains N addresses to other blocks?
N^2

65. Consider the producer-consumer problem with a buffer of capacity N. How many semaphores would you use to ensure operation correctness and what would be the semaphores' initial values?
2 semaphores with initial values 0, N and one that has the value 0 or 1:
1 indicates the number of occupied positions
1 inidicates the number of empty positions
1 ensures the exclusive access to the buffer when it is modified

66. Add the necessary instructions to the code fragment bellow, so that the standard input of command /bin/pwd to be read from PIPE p.

```
int p[2];
pipe(p);
if (fork() == 0) {
        close(p[1]);
        dup2(p[0],0);
        execl("/bin/pwd", "/bin/pwd", NULL);
        exit(0);
}
```

67. Given a directory and all its hierarchy, write a UNIX shell command that displays all sub-directories containing .c files.



```
if [ $# -lt 1 ]
then
        echo Please enter a directory
        exit 1
fi
for f in `find $1`
do
        if [ -d $f ]
        then
                texte=`ls -al $f | grep -E -i -c "^.*\.txt"`
                nrfis=`ls -al $f | grep -E -i -c ".*"`
                nrfis=$((nrfis-3))
                avg=$((texte/nrfis))
                echo $avg pentru directory $f
        fi
done
```

changes: do ls -l, grep and count the lines that contain at the end .c, if the number is greater than 0, print the directory

68. What will the code fragment below print to the console?

```
int p[2];
char buf[10];
int n;
pipe(p);
n = read(p[0], buf, 10);
printf("%d\n", n);
```

It will print nothing, because it will be stuck at the read. The writing end was not closed, so read will wait for data that will never come.

69. Write a UNIX shell command that displays all the lines in a file a.txt that contain at least a distance in kilometers.
grep -E "[0-9]+(\.*[0-9]+)?km" a.txt

70. Write a UNIX shell command that displays the lines of file a.txt swapping any pairs of upper case vowel followed by even digit (ex: a23E7I2BU4 -> a23E72IB4U).
sed -E "s/([AEIOU])([02468])/\2\1/g" a.txt

71. Write a UNIX Shell command that displays a list of all unique appearances of SCS usernames belonging to the english or romanian sections that appear in a text file a.txt.
grep -E -o "[a-z]{2}i[er][0-9]{4}" a.txt | sort | uniq -u

72. Why a hard-link can be created only towards files on the same partition and not toward files on other partitions?
A hard-link points to the same inode as the file. As the inode is a data structure used to represent a file-system object, it's internal to the File system, and you can't point to an inode of another file system.

73. What is the principle of locality regarding page loading?
A process is likely to need soon the pages next to the page that was just loaded.

74. What are the elements of a virtual address in the paged-segmented allocation and what tables are involved in calculating the physical address?
The elements of virtual address are (s, p, d), where s is the number of the segment, p is the number of the virtual page in the segment and d is the displacement in the page
The tables that are involved are the table of segments of a process and the table of pages for every cell of it points to a table of pages.

75. Given two set-associative caches, one with 2 sets of 4 pages and one with 4 sets of 2 pages, which would perform better for the following sequence of page requests: 17, 2, 37, 6, 9. Why?
17%2=1 and 17%4=1
2%2=0 and 2%4=2
37%2=1 and 37%4=1
6%2=0 and 6%4=2
9%2=1 and 9%4=1
The one with 2 sets of 4 pages is better because we'll stay in the first set, even though we have the same number of collisions.

76. What does the system call "write" do when the FIFO contains less space than the data it is required to write, but it is not full?
It will write as much data as it can.

77. Give the operators for the following Shell verifications:

- string is not empty: -n
- is executable: -x
- is different (for numbers): -ne
- is directory: -d