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Theoretical exercises
Spring 2022

Theoretical Exercises 1

Processes

Please submit solutions on Blackboard by Friday, 4.2.2022 12:00h

1.1 Unix processes and the shell

a. Init is the process at the top of the Unix process hierarchy. Explain why init has to run all the time when a Unix system is running.

b. Describe the function of `execl` in your own words (*Hint:* read the man page). Also describe the content of the second parameter passed to `execl`.

c. Explain the output of the following command in your own words. Which data is transferred through the pipeline and what operation does the `grep` command perform here?

```
ls | grep -vc .pdf
```

d. Try to find a shorter form of the following shell command that does not require a pipeline:

```
cat /etc/passwd | grep root | cat > /tmp/x
```

1.2 fork

Consider the following line of C code: (**Caution: Do not try to execute this!**)

```
while (fork());
```

a. Describe the program behavior after 1, 2, 3 and n iterations of the while loop.

b. The behavior of a program like this can lead to problems. Describe the problems that can occur. Try to find a way to avoid the problem in Unix (without changing the program above).

1.3 Process execution order

How many times does the following program print “Hello World”? Draw a simple tree diagram to show the parent-child hierarchy of the spawned processes.

```
1  #include <stdio.h>
2  #include <unistd.h>
3
4  int main() {
5    int i;
6    for (i = 0; i < 3; i++)
7      fork();
8    printf("Hello World\n");
9    return 0;
10 }
```