

Module 4 — Problem Sheet #2

Please upload a pdf file with your solutions (legibly hand-written and scanned, or a typeset document) to <https://jgrader.de> by the deadline stated above.

Problem 2.1: *process creation using fork()*

(20+30 = 50 points)

The Python function `os.getpid()` returns the process identifier (pid) of the calling process. The `os.fork()` function creates a new child process, which is an exact copy of the parent process. The `os.fork()` function returns 0 to the child process and the child's pid to the parent process.

Assume that all system calls succeed at runtime and that no other processes are created on the system during the execution of the program shown below. Furthermore, assume that process identifiers are allocated sequentially by the operating system kernel.

```
#!/usr/bin/env python3.3

import os
import time

x = 0
p = os.getpid()
os.fork()
x += 1
if (not os.fork()):
    x += 1
    if (os.fork()):
        x += 1

print("p%d: x = %d" % (os.getpid()-p, x))
time.sleep(2)
```

- What is the result produced by executing the program? Is the result always the same? Why or why not?
- Draw the process tree generated by running the program. Indicate the value of the variable `x` in each process at the time (i) the process is created and (ii) the process produces output.

Problem 2.2:

(10+15+15+10 = 50 points)

The course material contains a Python script to convert domain names into list of IP addresses and to convert the IP addresses back to domain names.

- Use the Python script to resolve the following domain names to IP addresses:

- www.google.com
- www.amazon.com
- www.facebook.com
- www.ietf.org
- www.apple.com

- Use <https://stat.ripe.net/> to lookup for each IP address to which autonomous system the IP address belongs.

- c) Use <https://www.maxmind.com/> to lookup for each IP address where the server is likely geographically located.
- d) Summarize your observations. Which services support IPv4 and IPv6? Which services use IP addresses that belong to the organization providing the service? Where are services located? If you ping the IP addresses, does the observed (minimum) round-trip time (rtt) match the reported geographic location?