IST-OPS Final Exam — December 2024

Name:

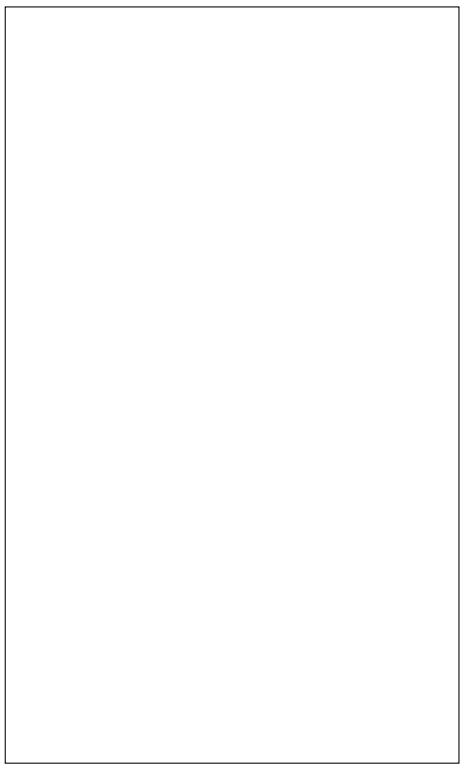
- First, write your name in the box above. Then, have a quick read through all 9 questions.
- In the end, you will write up your answers on this paper.
  - But please make a draft elsewhere first. Only hand in something readable. Really.
- This is an open-book open-laptop exam: you may work on scrap paper and/or on your screen.
  - But please refrain from cheating with e.g. ChatGPT, or your grade will be meaningless.
- Each question is independent from others, except stated otherwise.

1 General Unix knowledge

Question 1 For each acronym below, give the full unabbreviated expression.

INSA	Institut National des Sciences Appliquées
CLI	
CWD	
K&R	
PID	

Question 2 Propose a sequence of shell commands to create the directory structure illustrated below. At the beginning, the current folder is "`ops`" which we assume is empty. In your answer, no command line can contain a slash "/".



```
ops
├── folder1
│   ├── fileA
│   └── folder2
│       └── fileB
└── folder3
    └── folder4
        └── fileC
```

Question 3 Complete the command line below so that it prints only lines numbered X to Y (included) from the output of `somecommand`. X and Y represent two positive integers with X<Y, e.g. 2 and 5 (and in that case, we expect to see four lines of output).
Hint: to test your solution, use `somecommand` that produces explicit line numbers, like e.g. `seq 1 100` or `ls | nl`.

`somecommand |` [ ]

2 Kernel and syscalls

Question 4 In the list below, which system call(s) return control to the calling code when successful, and which don't? Please circle "Y" for "this function does return" and circle "N" for "this function does not return".

Y N exec
Y N exit
Y N fork
Y N getpid
Y N sleep
Y N wait

Question 5 In this question, we assume that we can make use of two functions for converting numbers from one representation to another: `int atoi(char * str)` and `char * itoa(int val)`.
We compile this program into an executable named `prog` and run it by typing `./prog 5`. How many times will the letter "Z" be displayed ?

This code will print "Z" [ ] times in total.

```
int main(int argc, char * argv[])
{
    assert(argc==2);
    int N=atoi(argv[1]);
    if(N)
    {
        fork();
        char * param=itoa(N-1);
        exec(argv[0], param);
        print('Z');
    }
    else
    {
        print('Z');
    }
}
```

3 Using `stdio.h`

Question 6 Write a program `hexo.c` which prints out each of its command-line arguments, both in text form then character by character, in hexadecimal notation.
For instance, running `./hexo az XYZ 1-2-3` should produce

```
az: 61 7a
XYZ: 58 59 5a
1-2-3: 31 2d 32 2d 33
```

```
int main(int argc, char* argv[])
{









}
```

Question 7 Write a program `slice.c` which expects two arguments X and Y, reads its standard input line-by-line and prints (on stdout) lines numbered X to Y. This is essentially the same spec as in question 3 but you are to implement it in C. In other words, `somecommand | ./slice 2 5` should print only the second to fifth lines of the output of `somecommand`.

```
int main(int argc, char* argv[])
{









}
```

4 Pointers and memory management

Question 8 We want to dynamically allocate an array of N integers, all initialized to 42. Complete the code below. You are not allowed to use the indexing operator "`[]`".

```
int* new_array(int N)
{
    int *tab =









   return tab;
}
```

5 Structured data types

Question 9 In the rectangle below, write down your implementation of function `reduce()` from chap. 8.