Intuitem - Internship self-assessment quiz

The purpose of this questionnaire is to qualify the suitability of the candidate application with the level of technological knowledge required to complete an internship at Intuitem. If an interview is organized, identical or similar questions will be asked.

The basic questions are intended to be processed without documents or computer. However, the answers may be either handwritten or typed in markdown.

Advanced problems can be carried out with the usual tools. The candidate is expected to solve only one problem among the given list.

Some domains will be out of scope depending of the internship subject, so it is anticipated that candidates will not be able to answer all questions (even some basic ones).

It is recommended to fill the quiz in 2 hours.

Basic questions (without documents nor calculator)

Mathematics

1/ Convert without a calculator 38247 in binary, octal and hexadecimal.

2/ Calculate the negation of this logical expression: (A and B or not (C and D)).

3/ Solve the following equation in the field of real numbers: (x*x + 3x + 5)(x - 3)(7x + 2) = 0

4/ In the usual 3-dimensional orthonormal coordinate system, let's consider the points A (1, 3 ,4), B (2, 5, 2) and C (3, 2, 7). Calculate the dot product of vectors AB and AC.

Algorithmics

5/ Provide in any computer language or in pseudo-code an algorithm to sort a table of integers, not using an existing "sort" function.

6/ Calculate the complexity of the proposed algorithm.

TCP/IP

7/ Give in CIDR notation the smallest subnet comprising 162.17.132.4 and 162.17.135.7

8/ Give the iptables commands that allow only incoming traffic on TCP port 443 on a host.

Linux

9/ Provide the commands to check the access permissions on a file, to change the owner, the group and the permissions of a file.

10/ Provide the standard library functions needed to realize a minimal TCP client and server.

C

11/ What does the following command display:

```c
printf("%06d\n", -255 & 0xFFFF);
```

Python

12/ What does the following command display:

```python
j = 0
k = 1
for i in range(11):
    j, k = j + k, j
    print(f'F{i:<2} = {k}')
```

Cryptography

13/ Present the principles and purpose of the Diffie-Hellman algorithm.

git

14/ Let consider a directory with the following files: pagerank.c, pagerank.h and makefile. Provide the commands to create a repository and save the given files in it.

K8s

15/ Provide a few basic K8s commands and explain their purpose.

Advanced questions - Select one problem in the follwing list and provide a solution using adapted tools

P1/ Using a Python notebook, write a program that calculates the eigenvalues and eigenvectors of the following matrix:

```
 3 -3  2
-1  5 -2
-1  3  0
```

Use the result to explain the concepts of eigenvalues and eigenvectors.

P2/ Using the language of your choice, write a program that, given as a parameter a website home URL, recursively fetches all URLs within the same website, and lists all gathered URLs with document size and number of links to other URLs of the same website.

P3/ Using the language of your choice, write a program that produces instructions to solve the Tower of Hanoi problem, with the number of levels given as a parameter on the command line.

P4/ Using the language of your choice, write a program that dumps IPv4 packets given in hexadecimal format on the standard input (one line per packet), describing main fields. Provide an example file.