WORK4

Dev Test

Below is our test for prospective developers.

We mainly use Python for server-side code, but you can answer these questions in the language of your choice if you do not know this language well.

We favor accuracy highly, and we'd rather you answer fewer questions with greater accuracy than more questions with less accuracy. The questions become progressively harder through each section. Make sure the code you send is functional, and does not have syntax errors. Using search engines and online documentation is strongly encouraged.

At Work4, we highly value creativity, and we like to test it at all stages in the recruitment process. You can find our 3 Creativity questions in section 4. Show us how creative you can get!

Please fill the answers in this document.

Good luck!

[All] 0. Candidate details

Please fill in the following information - so we know you better.

- Contact info:
  - Name :
  - Phone number :
  - Skype id :
- School / University :
- Specialty / Major :
- Type of application (internship or full time):
- Start date:
- If internship
  - length of internship:
  - Looking for full time position after:
- Location (Paris or San Francisco):
- Experience in programming (briefly):
- Technologies mastered:

[Backend] 1. Object-oriented programming, algorithms

1. What difference is there between class and instance variables?
2. Detail the steps of the Bubble sort algorithm applied to the following vector:
   `["celery", "carrot", "cabbage", "tomato"]`
3. We consider an array A[1...n]. Write a function that returns
   $$Max_{i=1..n, j \leq i}(A[i] - A[j])$$
   (the largest difference in the array between a value and another value with a smaller index)
4. An array A[1....n] is said to have a majority element if more than half of its entries are the same. Given an array, design an efficient algorithm to tell whether the array has a majority element, and, if so, to find that element. The elements of the array are not necessarily from some ordered domain like integers, and so there can be no comparisons of the form "is A[i] > A[j]?". However you can answer questions of the form: "is A[i] = A[j]?" in constant time.

[Backend] 2. Programming

1. Give a regular expression that detects hexadecimal numbers in a text, for example '0x0f4', '0acdadecf822eeff32aca5830e438cb54aa722e3', '8BADF00D' should be detected. Bonus points for writing a test case.
2. Write two classes, one to represent a rectangle, the second a square. They must have an appropriate constructor (width, height for the rectangle, width for the square) and area and perimeter calculation methods. Code duplication must be avoided as much as possible. Please explain your implementation choices.
3. Write a function that given an XML document (as a string) returns the number of attributes for each occurrence of the most common tag type. For instance, if the "a" tag is the most common in the provided document, it should count the total number of attributes of all "a" tags in the document.
4. Here is the pseudo code of a function that is defined recursively:
   f(0) = 1;
   f(1) = 3;
   f(n) = 3 * f(n - 1) - f(n - 2);
   Provide an implementation for 'f'. Bonus points for a non recursive implementation.

[Backend] 3. MySQL

1. Write a `CREATE TABLE` query for a table storing information on users. It will store `id`, `firstname`, `lastname`, `gender`, `email`, `created_at`.
2. Write a query on the previous table that lists the 10 most recently added users.
3. Write a query listing emails used by more than one user.
4. Same question as (3), but using a `LEFT JOIN` instead of a `GROUP BY` operation.

[General] 4. Creativity

1. Describe the color yellow to someone who is blind
2. Invent an object that is totally crazy and not necessarily useful
3. Describe the data model you'd use for a Battleship game. What are the key objects? How will your code use them?