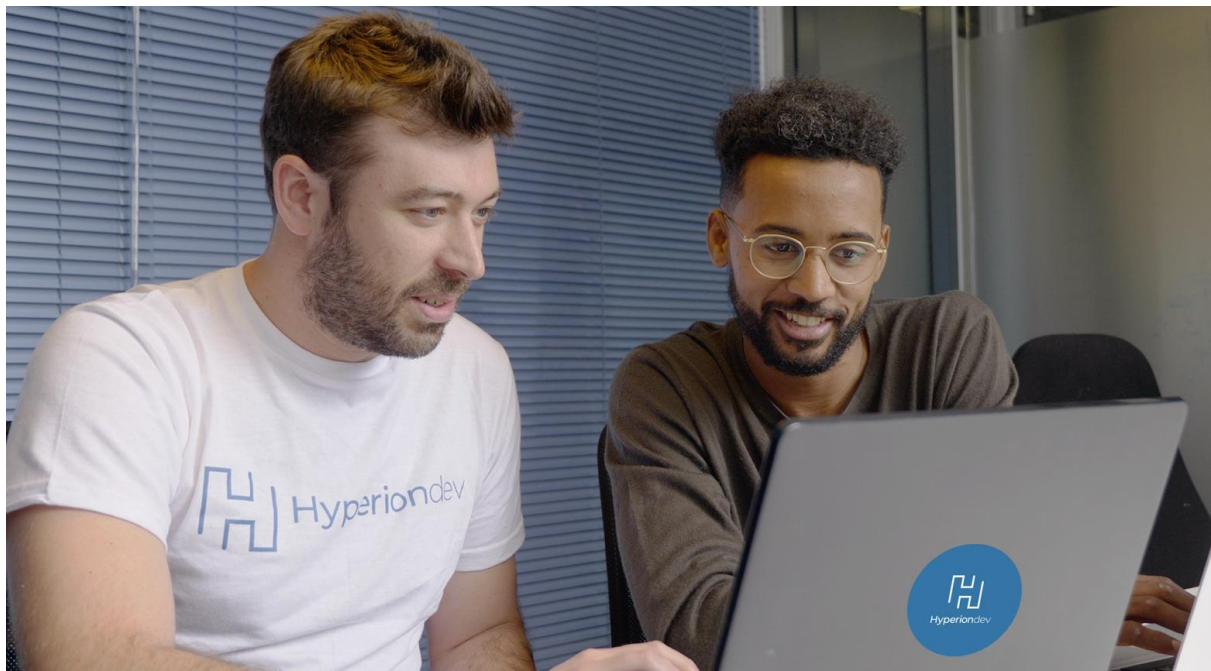


TAKE-HOME TEST - WRITTEN ASSESSMENT

Code Reviewer

2021



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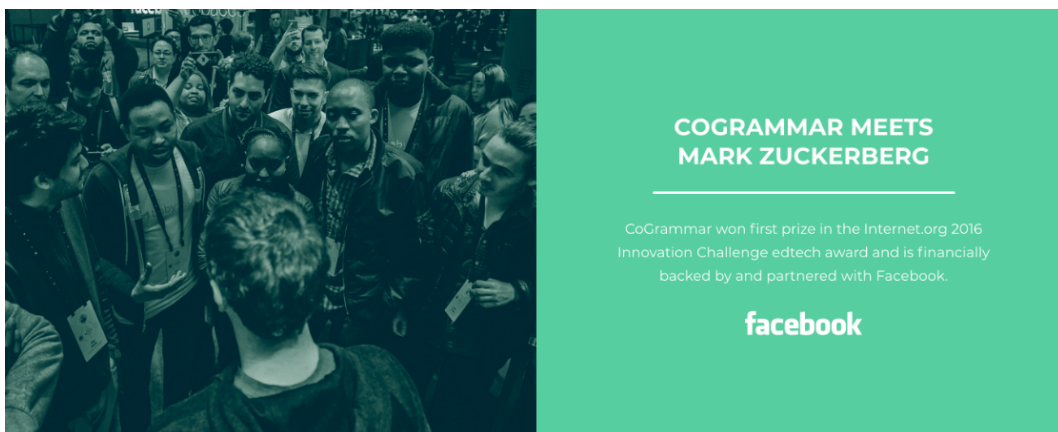
Welcome

We're excited to get to know you and your skills better. The next step of the interview process with CoGrammar is to complete a take-home exercise. Please complete this exercise within **7 calendar days** of receiving it and make sure your responses are all sent through to the email ID from which you received this assessment unless otherwise specified.

Who are we?

CoGrammar is recognised as one of the top education technology startups in Europe, the Middle East, and Africa. Founded by [Riaz Moola](#) in 2012, CoGrammar's leadership team consists of ex-Google, Amazon, PwC, Yoco, Groupon employees, senior team members from GetSmarter (most valuable edtech startup in South Africa, acquired for >R1.5 billion) and graduates of the University of Cambridge, Cape Town, and Oxford. [HyperionDev](#) is our coding education product.

CoGrammar was funded by Facebook and Google in 2017 - winning first prize in Facebook's Africa Innovation Challenge Award as the top edtech startup on the African continent. CoGrammar works directly with Facebook's senior leadership - right up to Mark Zuckerberg himself - and through its headquarters in London, is recognised as a leading edtech startup in Europe, the Middle East, And Africa. CoGrammar was recently recognised as one of the top 5 edtech startups in South Africa and is supported by top global edtech investors, including the edtech fund behind [Coursera](#), [Andela](#), [Udemy](#), & [SoloLearn](#).



We have built an online course platform that allows human code review to be scaled, applying this methodology to help thousands of students from over 30 countries learn how to code in a novel way. We pioneer effective and affordable software development education with this code review model, lowering the cost of access to tech careers around the world to shrink the tech skills gap and

inequalities in the tech space.

Being a Code Reviewer

In this role, you will be joining our team of specialist Code Reviewers, also called CoGrammars. Our CoGrammars are elite, world-leading programming experts with a skill set that is at the intersection of technical coding skills. CoGrammars work with leading tech partners from around the world in fields as diverse as technical education, developer assessment, and tech team peer reviews.

Pursuing code review as a part-time opportunity provides a fulfilling way of specializing yourself further while garnering international work experience while being a full-time Code Reviewer is a promising career path with a trajectory similar to that of a traditional educator and compensation/benefits rivalling those in the software & IT industry.

Please complete the tasks below to help us understand how your skills may best fit the requirements of our team.

Instructions

- Please attempt every section.
- Please submit a link to a single publicly accessible GitHub repository that contains your solutions with a folder for each section.
- Please validate user input and handle all errors gracefully.
- No runtime errors or exceptions should be encountered while running your solutions.
- Please provide a README.md file in each section's folder describing setup and usage where applicable.
- If you deployed or published a solution, please include information about it in the corresponding README.md file, e.g. how to access the running application.
- Please include project files that would automate the installation of your dependencies.
- Please exclude any binaries or generated files, e.g. node_modules.
- Please include tests where possible.
- Please containerise your solutions where possible.
- We will assess your submission based on:
 - The thoroughness of your submission
 - Use of the data provided
 - Creativity
 - Research efforts
 - Presentation
 - Completion within the allocated time.
- Best wishes!

Section A: Code Review

This section simulates a typical interaction that you might have with a student. You will be given a question that a hypothetical student asks and the student's submitted code. You will be required to answer the question and review their code's correctness, efficiency, style and documentation.

Instructions

- Please select exactly one option for a programming language you will NOT use in Section B or C (e.g. if you choose to complete option 3 in Section A (JavaScript), you may not choose option 1 in Section B or code your answer in JavaScript in Section C. We want to see your proficiency in a variety of languages).
- Please present your review in a Markdown file.
- Please refer to line numbers in your review.
- Please copy and paste the code into your editor for a more ergonomic review experience.

Options

Option 1: Python

Student Question

Hi there,

I'm having a bit of an issue with figuring out how to exactly implement the class methods so that I may call them outside of the class when trying to create a new SMS object.

*Thanks,
Student*

Code Submission

```
# An SMS Simulation class SMSMessage(object):
hasBeenRead = False messageText = text fromNumber = number
def __init__(self,hasBeenRead,messageText,fromNumber):
    self.hasBeenRead = False self.messageText = text
self.fromNumber = number

def MarkASRead(self):
    if userChoice == read:
        self.hasBeenRead = True

def add_sms():
def get_count():
def get_message():
def get_unread_messages():
def remove():

no_1 = SMSMessage(False, "Hello", "0798653452")
no_2 = SMSMessage(False, "WYD", "0845673864")
no_3 = SMSMessage(False, "How are you?", "0631873298")
SMSStore = [] userChoice = ""

while userChoice != "quit":
    userChoice = raw_input("What would you like to do -
read/send/quit?")
    if userChoice == "read":
        # Place your logic here elif userChoice == "send": #
Place your logic here elif userChoice == "quit":
        print("Goodbye")
    else:
        print("Oops - incorrect input")
```

Option 2: Java

Student Question

Hi there,

I am trying to do Task 6 and JOptionPane.ShowDialog() does not work. For some reason, it does not store the input to the string variable it is assigned to, so my do-while loop ends up in an infinite loop. Can you please help me?

*Thanks,
Student*

Task

For context, the task the student is working on is as follows:

- Create a new file called do_whilePassword.java.
- Imagine that the password to sign in to some computer is "John". Write a program that prompts the user to enter a password to log in to this imaginary computer.
- If the user enters the correct password, then notify the user and terminate the program.
- Should the user get the password incorrect three times in a row, then inform the user of the current password and allow the user to set a new password.
- Check the new password so that it satisfies these modified Java identifier rules:
 - The password may have any number of characters between 1 and 20, inclusive.
 - The password may start with an underscore "_" or any letter of the alphabet.
 - The password may be any combination of upper and lower case letters.
 - The password consists only of numbers, English alphabet letters, and the underscore character.
- Should a proposed password not match these rules, then inform the user that they have entered an invalid password and prompt the user to try again until an acceptable password is found.
- Here is an example run on the assumption that the current password is "John":

Prompt: Enter password:

input: peter

Prompt: Incorrect password. Please enter the password:

input: luke

Prompt: Incorrect password. Please enter the password:

input: jane

Prompt: Password incorrect on three attempts.

Prompt: The password was John. Please set a new user password:

input: john123

Prompt: password changed.

- Compile, save and run your file.

Code Submission

```
import java.util.*; import javax.swing.*;
public class do_whilePassword {
    public static void main ( String [] args ) {
        String choice = ""; do {
            //System.out.println( "Enter today's number from the
            menu:" ); choice = JOptionPane.showInputDialog("Please enter in a
            password");
        }while(choice != "John" ); } }
```


Option 3: JavaScript

Student Question

Hi there,

I currently have a moveable character on a webpage, but I want to prevent it from going out of the screen's bounds. Please could you give me an idea of how to approach this problem?

*Thanks,
Student*

Code Submission

Example.html

```
<!DOCTYPE html>
<html>
  <head>
    <link rel='stylesheet' type='text/css'
href='stylesheet.css' />
    <script
src="https://ajax.googleapis.com/ajax/libs/jquery/1.12.4/jquery.m
in.js"></script>      <!--Including jQuery -->
    <script type='text/javascript' src="script.js"></script>
<!-- Including the scripting file -->
  </head>
  <body>
    
  </body>
</html>
```

Script.js

```
$(document).ready(function () {
    alert("This page has loaded!");
    //Below is code which hides a paragraph when the button is
    clicked $("button").click(function(){
        $("p").hide("slow", function () {
            alert("The paragraph is now hidden");
        });
    });
}); //let width=Math.max($(document).width(), $(window).width());
//let height=Math.max($(document).height(), $(window).height()); let
height=$(window).height(); let width=$(window).width(); //Below is
code which allows for the character to move - why not try craft your
own version?
$(document).keydown(function (key) {
    //document.write(Math.max($(document).height(),
    $(window).height())); //
    document.write(Math.max($(document).width(), $(window).width()));
    switch (parseInt(key.which, 10)) {
        // Left arrow key pressed case 37:
        if ($('#img').position().left > 0) {
            $('#img').animate({
                left: "-=20px"
            }, 'fast');
        }
        break; // Up Arrow Pressed case 38:
        $('#img').animate({
            top: "-=20px"
        }, 'fast');
        break; // Right Arrow Pressed case 39:
        if ($('#img').position().left < width){
            $('#img').animate({
                left: "+=20px"
            }, 'fast');
        }
        break; // Down Arrow Pressed case 40:
        $('#img').animate({
```

```
        top: '+=20px'  
    }, 'fast');  
    break;  
}  
});  
});
```

Stylesheet.css

```
img {  
    position: relative;  
    left: 0;  
    top: 0;  
}  
  
body {  
    width: 100%;  
    height: 100%;  
    background: cyan;  
    overflow: auto;  
}
```

Option 4: Ruby

Student Question

Hi there,

*I'm having issues with the custom spellchecker I was asked to build. When I use the input "cat ct", I'm not getting "cat *ct*" as expected. Could you please point me in the right direction?*

Thanks,

Student

Task

For context, the task the student is working on is as follows:

- Create a custom spellchecker.
- The application should take as input a string of words separated by spaces.
- Any incorrectly spelt words should have an asterisk on either side.
 - For example, "cat ct" -> "cat *ct*"
- Eventually, it should be able to check the words of common types of pets, namely cat, dog, rabbit, hamster, budgie and parrot, with the potential to expand this in the future.
- You should not use a loop to solve the problem.

Code Submission

```
class Spelling_Checker
  def initialize()
    @words = ['catt', 'ct', 'caaat', 'tcat']
  end

  def spellChecker(string)
    array = string.split(" ")

    array.each{ |n|

      if @words.include? n
        "*#{n}*"
      end
    }.join(" ")
  end
end

checker = Spelling_Checker.new
output = checker.spellChecker("cat ct")
p output
```

Section B: Domain Speciality

This section will assess your speciality in either web development, data science, or software development.

Instructions

- Please select exactly one option.
- Please use the prescribed programming languages and technologies. (Remember, you may not choose the same language that you chose in Section A).
- Deploy or publish your work as described in each option.

Options

Option 1: Web Development

Please develop an application of your choice in either TypeScript or JavaScript that meets the following requirements:

- The application creates, reads, updates and deletes data.
- The frontend is built with a frontend framework such as React.
- The backend is built with a Node.js framework such as Express.
- The application uses JWT.
- The application uses a relational or non-relational database engine.
- The application is deployed on a service such as AWS.

Option 2: Data Science

Please create a Jupyter notebook and find a dataset that meets the following requirements:

- It has many features and rows, preferably a good mix of categorical and continuous data.
- The dataset needs to be entirely new for you.
- Optionally don't pick a dataset that is already perfect, as this will minimise and take away from the steps you'd need to follow for this task.

You then need to:

- Read in the dataset.
- Clean the dataset, motivating your steps.
- Analyse the dataset, including appropriate visualisations.
- Note down all the findings and conclusions you're making in a report at the end.
- Create a blog post to document your findings.

Option 3: Software Development

Please develop an application of your choice in either Ruby or Java that meets the following requirements:

- The application creates, reads, updates and deletes data.
- The application provides an HTML and CSS-based user interface. No JavaScript is necessary.
- The application is deployed on a service such as AWS.
- The application involves user authentication.
- The application uses a relational database engine.

Section C: Problem-Solving

Instructions

- Please select exactly one option.
- Please choose any programming language that you are most comfortable working with for this section (Remember, you may not choose the same language that you chose in Section A).
- You may not use any module, package, library or framework, whether in-built or not, that directly solves the problem under the hood, e.g. “sklearn.cluster.KMeans” module in Python.

Options

Option 1: K-Means Algorithm

Please implement the K-means algorithm and meet the following requirements:

- For the dataset, generate the dataset using built-in tools from the programming language. Use your preferred labels for the outputs.
- There should be two options to train the model: either train the model with defaults for the number of iterations and the “k” value or accept user input for the same values.
- Present your findings regarding the clusters, either using visualisations (for this, pick any library you see fit) or by printing them in a tabular format.
- Pick any evaluation metric(s) you see fit and report on your findings.

Option 2: String Calculator

Please develop a calculator that meets the following requirements:

- We expect the calculator to evaluate the following expressions. You can use the examples of input -> output for testing.
 - Value, e.g. "3.2" -> "3.2"
 - Factorial, e.g. "factorial 5" -> "120"
 - Highest prime number under a given value, e.g. "prime 10" -> "7"
 - Highest Fibonacci number under a given value, e.g. "fibonacci 12" -> "8"
 - Addition, e.g. "+ 12.5 12.5" -> "25"
 - Subtraction, e.g. "- 43.7 50" -> "-6.3"
 - Multiplication, e.g. "* 6 -12" -> "72"
 - Division, e.g. "/ 20 10" -> "2"
 - Long arithmetic expressions, e.g. "+ 2 3 4 10" -> "19"
 - Nested expressions where parentheses surround subexpressions, e.g. "/ (factorial (* 2 2 5)) 600" -> "12096"
 - Expressions with contiguous whitespace, e.g. "\t 3.22 \t\t\t " -> "3.22"
- The input is a string and the output is a string.
- Operators prefix their operands in expressions.
- It handles integers, floating-point numbers and negative numbers.
- It removes the fractional part of the result if the said fractional part is equivalent to 0, e.g. 4.0 becomes 4.
- It gracefully handles overflows.

Section D: Asymptotic Computational Complexity

Instructions

- Please select exactly one option.
- Please provide your response in a Markdown file.
- Please provide justifications for your conclusions.
- Please note that both options are in JavaScript.

Options

Option 1: Space Complexity

Please report on the following:

- The worst-case space complexity of the “doBracketsMatch” function.
- The worst-case space complexity of the “doBracketsMatch” function if we extended it to support multiple pairs of opening and closing brackets.
- At least two alternative design changes that would affect the extension.

```

function BracketStack() {
    let openBracketsCount = 0

    this.isEmpty = function() {
        return openBracketsCount === 0
    }

    this.push = function() {
        openBracketsCount++
    }
    /**
     * @throws If stack is empty
     */
    this.pop = function() {
        if (this.isEmpty()) throw new Error("Cannot pop empty stack")
        openBracketsCount--
    }
}

/**
 * @param {string} symbol
 * @returns A function that checks if a given value is the symbol
 */
function isSymbol(symbol) {
    /**
     * @param {string} value
     * @returns {boolean}
     */
    function check(value) {
        return symbol === value
    }
    return check
}

/**
 * Checks if a pair of brackets match
 * @param {string} inputString
 * @param {string} openingSymbol

```

```
* @param {string} closingSymbol
*/
function doBracketsMatch(inputString, openingSymbol, closingSymbol)
{
    let stack = new BracketStack()
    let isOpeningSymbol = isSymbol(openingSymbol)
    let isClosingSymbol = isSymbol(closingSymbol)
    for (let i = 0; i < inputString.length; i++) {
        let value = inputString[i]
        if (isOpeningSymbol(value)) stack.push()
        if (isClosingSymbol(value))
            if (stack.isEmpty()) return false
            else stack.pop()
    }
    return stack.isEmpty()
}
```

Option 2: Time Complexity

Please report on the following:

- The worst-case time complexity of the “Collection.add” method.
- At least two alternative designs that would improve the worst-case time complexity without using arrays or any other predefined collection type.
- The worst-case time complexity of the alternative designs.

```
class Collection {  
  #value  
  #next  
  
  constructor(value, next) {  
    this.#value = value  
    if (next) this.#next = new Collection(next)  
    else this.#next = null  
  }  
  
  get value() { return this.#value }  
  
  get next() { return this.#next }  
  
  add(value) {  
    let next  
    for (next = this.#next; next && next.#next; next = next.#next) ;  
    if (!next) next = this  
    next.#next = new Collection(value)  
  }  
}
```