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Programming

This section consists of 10 programming questions, you can use JavaScript, Java or C# as your preferred language. To submit the test, please create a public repository on Github and commit your answers there.

1. What is the difference between protected and private fields/methods? (1 mark)

Private fields and methods can only be accessed within the class itself.

Protected fields and methods can be accessed within the class itself AND by classes within the same package or a sub-class.

1. How do you declare a ten integer array? (1 mark)

new int[10]

1. Write a function to print out all numbers between 200 and 1000 which are divisible by 9 but not divisible by 20. (2 marks)

void getDivisibleByNineButNotTwenty() {

for (int i = 200; i <= 1000; i++) {

if (i%9 == 0 && i%20 != 0) {

System.out.println(i);

}

}

}

1. Write a function to determine if a word is a palindrome, a word that reads the same forwards as it does backwards. For example ANNA, BOB, PEEP, etc.

The function should take one parameter which is a String and return a Boolean value depending on whether or not the parameter is a palindrome. (3 marks)

boolean isPalindrome(String word) {

if (word) {

String reverse = new StringBuilder(word).reverse().toString();

return word.compareTo(reverse) == 0;

} else {

return false; // assume null is not a palindrome as not a word

}

}

1. What is the output of the following code segment? (2 marks)

int myCounter = 4;

do {

  myCounter = myCounter+1;

   System.out.println(myCounter);

} while (myCounter<=3);

      System.out.println(myCounter);

5

5

1. Write a SQL query to output movies from the given table with an odd numbered id and with the description that does not contain ‘3D’, order the result by rating (1 mark)

For example: table movies:

A screenshot of a cell phone

Description automatically generated

SELECT \* FROM movies WHERE( id % 2 ) = 1 AND NOT (description LIKE "%3D%") ORDER BY rating DESC;

1. The Fibonacci sequence is a series of numbers where a number is found by adding up the two numbers before it. Starting with 0 and 1, the sequence goes 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, and so forth.

Write a function that takes in an integer n as a parameter, and returns the nth number in the Fibonacci sequence. (3 marks)

Integer getFibonacci(Integer n) {

if (n == 0) return 0;

if (n == 1) return 0;

if (n == 2) return 1;

Integer twoBack = 0;

Integer oneBack = 1;

Integer current = 1;

for (int i = 3; i < n; i++) {

twoBack = oneBack;

oneBack = current;

current = twoBack + oneBack;

}

return current;

}

1. A number is divisible by 3 if and only if the sum of its digits are divisible by 3.

Example: 123 is divisible by 3 since 1+2+3 = 6 is.

1. not divisible by 3 since 1+2+4 = 7 is not.

Write a function which will take a number stored as a string as a parameter and return a boolean to determine if the number is divisible by 3. By using a string to store the number we should be able to determine whether or not very long numbers are divisible by 3. (4 marks)

boolean divisibleByThree(String number) {

int accumulator = 0;

for (int i = 0; i < number.length(); i++) {

accumulator += number.charAt(i) - ‘0’;

}

if (accumulator != 0 && accumulator%3 == 0) return true;

return false;

}

1. For two strings str and t, We define that "t divides str " if and only if str = t + ... + t (t repeats itself n times, n >= 1)

Please write a function that takes two strings str1 and str2 as inputs, and outputs the largest string x such that x divides both str1 and str2. (6 marks)

**Example 1:**

**Input:** str1 = "XYZXYZ", str2 = "XYZ"

**Output:** "XYZ"

**Example 2:**

**Input:** str1 = "HOHOHO", str2 = "HOHO"

**Output:** "HO"

**Example 3:**

**Input:** str1 = "PURE", str2 = "FACTS"

**Output:** ""

**Example 4:**

**Input:** str1 = "ABCDEF", str2 = "ABC"

**Output:** ""

**Constraints:**

* 1 <= str1.length <= 1000
* 1 <= str2.length <= 1000
* str1 and str2 consist of English uppercase letters.

int getGcd(int numberOne, int numberTwo) {

if (numberTwo == 0) return numberOne;

return getGcd(numberTwo, numberOne%numberTwo);

}

String gcdOfStrings(String str1, String str2) {

if (str1 == str2) return str1;

if (!(str1 + str2).equals(str2 + str1)) return "";

int str1Length = str1.length();

int str2Length = str2.length();

int lengthGcd = getGcd(str1Length, str2Length);

return str1.substring(0, lengthGcd);

}

1. Write a function that takes a 2-dimentional array coordinates as input, where each elements of array coordinates is in shape of [x, y] representing the coordinate of a point. The function will output a Boolean value whether all points in the array falls on a straight line in the XY plane. (6 marks)  
     
   Explain the time complexity and space complexity of your algorithm. (1 marks)

**Example 1:**

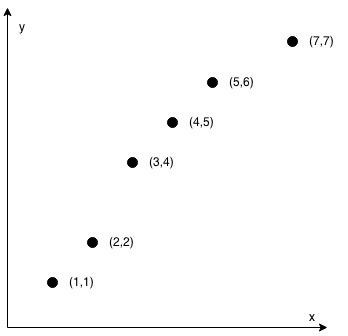
A picture containing photo, skiing, table, person

Description automatically generated

**Input:** coordinates = [[1,2],[2,3],[3,4],[4,5],[5,6],[6,7]]

**Output:** true

**Example 2:**

****

**Input:** coordinates = [[1,1],[2,2],[3,4],[4,5],[5,6],[7,7]]

**Output:** false

float getSlope(int[] coordinatesOne, int[] coordinateTwo) {

return (coordinateTwo[1]-coordinatesOne[1])/(coordinateTwo[0]-coordinatesOne[0]);

}

boolean checkStraightLine(int[][] coordinates) {

if (coordinates.length < 3) return true; // technically a single point exists on a straight line

float slope = getSlope(coordinates[0], coordinates[1]);

for (int i = 2; i < coordinates.length; i++) {

if (Float.compare(getSlope(coordinates[i-1], coordinates[i]), slope) != 0) {

return false;

}

}

return true;

}

Time complexity: O(n)

Space complexity: O(1)