

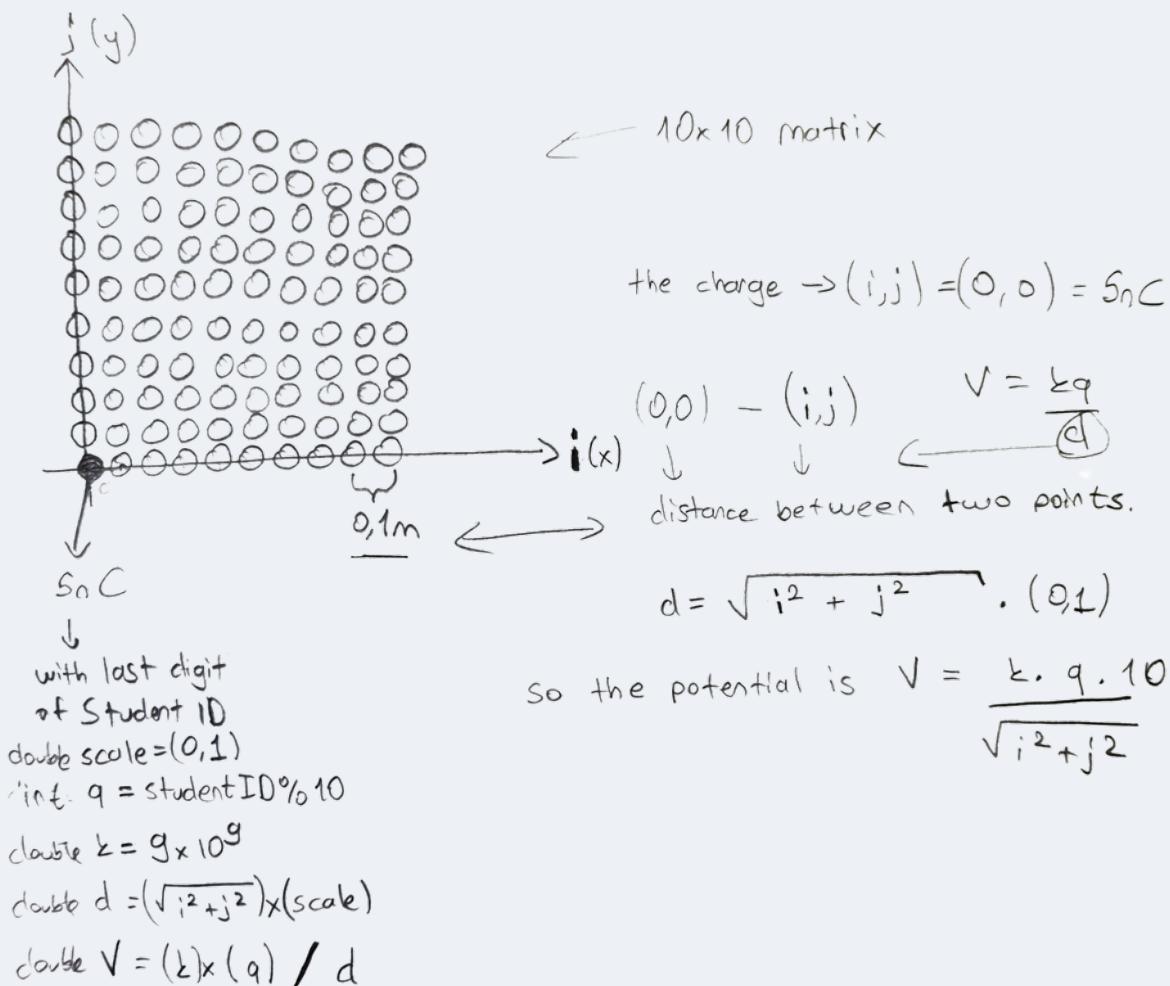
AKDENİZ UNIVERSITY 2023 SPRING PHYSICS FOR COMPUTER SCIENCE II HOMEWORK

1) 75p Write a code (python or java or MS excel or any other language) to calculate the following: In this problem we will calculate the electric potential of a point charge at various points. The charge will be located at the bottom left of the matrix. Each cell is 0.1 m long. The charge is the last digit of your ID number in nC (nanocoulomb). If your id no is 20??????13, your charge is 3 nC, if 20??????01 your charge is 1nC ...etc.

SOLUTION

1)

Step 1 - I review the problem and created a path for solving solution on paper.



All of the project is available on my [GitHub](#).

Step 2 - I wrote a java code for the calculations.

```
public class electric_potential {  
    public static void main(String[] args) {  
        // Öğrenci numarası ve yük hesaplamaları  
        int studentId = 20808005; // Öğrenci numarası  
        double charge = (studentId % 10) * 1e-9; // nC cinsinden yük  
        double epsilon_0 = 8.85e-12; // C^2/(N·m^2)  
        // Matris boyutu ve hücre uzunluğu  
        int matrixSize = 10;  
        double cellLength = 0.1; // metre  
        // Potansiyel matrisi oluşturma  
        double[][] potentialMatrix = new double[matrixSize][matrixSize];  
        // Potansiyel hesaplama fonksiyonu  
        for (int i = 0; i < matrixSize; i++) {  
            for (int j = 0; j < matrixSize; j++) {  
                double x = i * cellLength;  
                double y = j * cellLength;  
                potentialMatrix[i][j] = calculatePotential(charge, x, y, epsilon_0); } }  
        // Potansiyel matrisini yazdırma  
        for (int i = 0; i < matrixSize; i++) {  
            for (int j = 0; j < matrixSize; j++) {  
                System.out.printf("%.2e ", potentialMatrix[i][j]);}  
            System.out.println(); } }  
        public static double calculatePotential(double q, double x, double y, double epsilon_0) {  
            double r = Math.sqrt(x * x + y * y);  
            if (r == 0) { return Double.POSITIVE_INFINITY; // Sonsuz potansiyel }  
            return q / (4 * Math.PI * epsilon_0 * r); } }
```

The Output :

```
Infinity 4,50e+02 2,25e+02 1,50e+02 1,12e+02 8,99e+01 7,49e+01 6,42e+01 5,62e+01 5,00e+01  
4,50e+02 3,18e+02 2,01e+02 1,42e+02 1,09e+02 8,82e+01 7,39e+01 6,36e+01 5,58e+01 4,96e+01  
2,25e+02 2,01e+02 1,59e+02 1,25e+02 1,01e+02 8,35e+01 7,11e+01 6,18e+01 5,45e+01 4,88e+01  
1,50e+02 1,42e+02 1,25e+02 1,06e+02 8,99e+01 7,71e+01 6,70e+01 5,90e+01 5,26e+01 4,74e+01  
1,12e+02 1,09e+02 1,01e+02 8,99e+01 7,95e+01 7,02e+01 6,23e+01 5,58e+01 5,03e+01 4,56e+01  
8,99e+01 8,82e+01 8,35e+01 7,71e+01 7,02e+01 6,36e+01 5,76e+01 5,23e+01 4,77e+01 4,37e+01  
7,49e+01 7,39e+01 7,11e+01 6,70e+01 6,23e+01 5,76e+01 5,30e+01 4,88e+01 4,50e+01 4,16e+01  
6,42e+01 6,36e+01 6,18e+01 5,90e+01 5,58e+01 5,23e+01 4,88e+01 4,54e+01 4,23e+01 3,94e+01  
5,62e+01 5,58e+01 5,45e+01 5,26e+01 5,03e+01 4,77e+01 4,50e+01 4,23e+01 3,97e+01 3,73e+01  
5,00e+01 4,96e+01 4,88e+01 4,74e+01 4,56e+01 4,37e+01 4,16e+01 3,94e+01 3,73e+01 3,53e+01
```

Step 3 - I asked ChatGPT for turn the code into python for plotting the graphs.

Here are the conversation:

```
    }

    public static double calculatePotential(double q, double x, double y,
double epsilon_0) {
        double r = Math.sqrt(x * x + y * y);
        if (r == 0) {
            return Double.POSITIVE_INFINITY; // Sonsuz potansiyel
        }
        return q / (4 * Math.PI * epsilon_0 * r);
    }
}
```

bu kodu python dilinde yazar mısın?



Elbette! İşte yukarıdaki Java kodunun Python dilinde yazılmış hali:

```
python

import numpy as np

# Öğrenci numarası ve yük hesaplamaları
student_id = 123456789 # Öğrenci numaranızı buraya girin
charge = (student_id % 10) * 1e-9 # nC cinsinden yük
epsilon_0 = 8.85e-12 # C^2/(N·m^2)

# Matris boyutu ve hücre uzunluğu
matrix_size = 10
```

And I use ChatGPT again for plotting.

Step 4 - And I use ChatGPT again for plotting.

Tamamdır şimdi bunu grafikleştirmemiz lazım. matrisin 2 boyutlu grafiği, x'e göre potansiyel yani i ye göre ,çapraz gidildikçe potansiyelin nasıl değiştiği i=1 j=1 den i=9 j=9 a kadar .ve eşpotansiyel çizgilerini gösteren grafikler oluşturacağız. pythonda yapar misin bunu?



Tabii, yukarıda belirttiğiniz gereksinimleri karşılayan bir Python kodu yazalım ve gerekli grafiklerle birlikte sonuçları görselleştirelim. Ödevde belirtilen her bir adımı dikkate alarak, matrisin potansiyel hesaplamlarını yapıp, ilgili grafikleri oluşturan kodu aşağıda bulabilirsiniz:

```
python

import numpy as np
import matplotlib.pyplot as plt

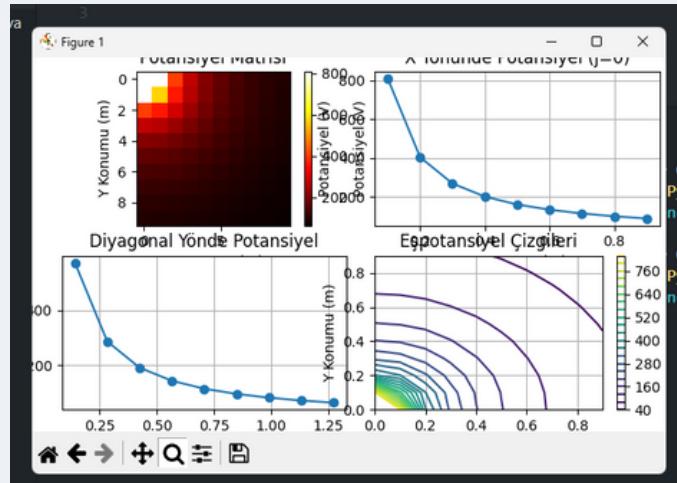
# Yük ve sabitler
student_id = 123456789 # Öğrenci numaranızı buraya girin
charge = (student_id % 10) * 1e-9 # nC cinsinden yük
epsilon_0 = 8.85e-12 # C^2/(N·m^2)

# Matris boyutu ve hücre uzunluğu
matrix_size = 10
cell_length = 0.1 # metre

# Potansiyel hesaplama fonksiyonu
def calculate_potential(q, x, y):
    r = np.sqrt(x**2 + y**2)
    if r == 0:
```

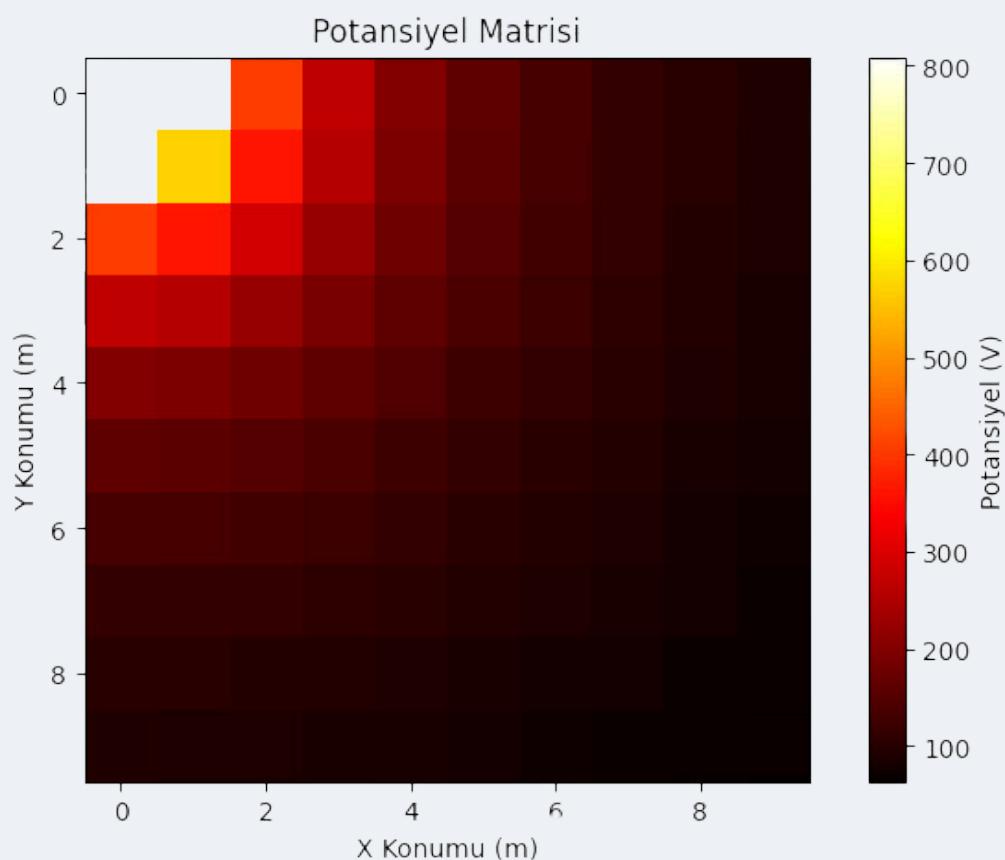
Kodu kopyala

Step 5 - I checked that if the graphs created by code are the same with my expectation.



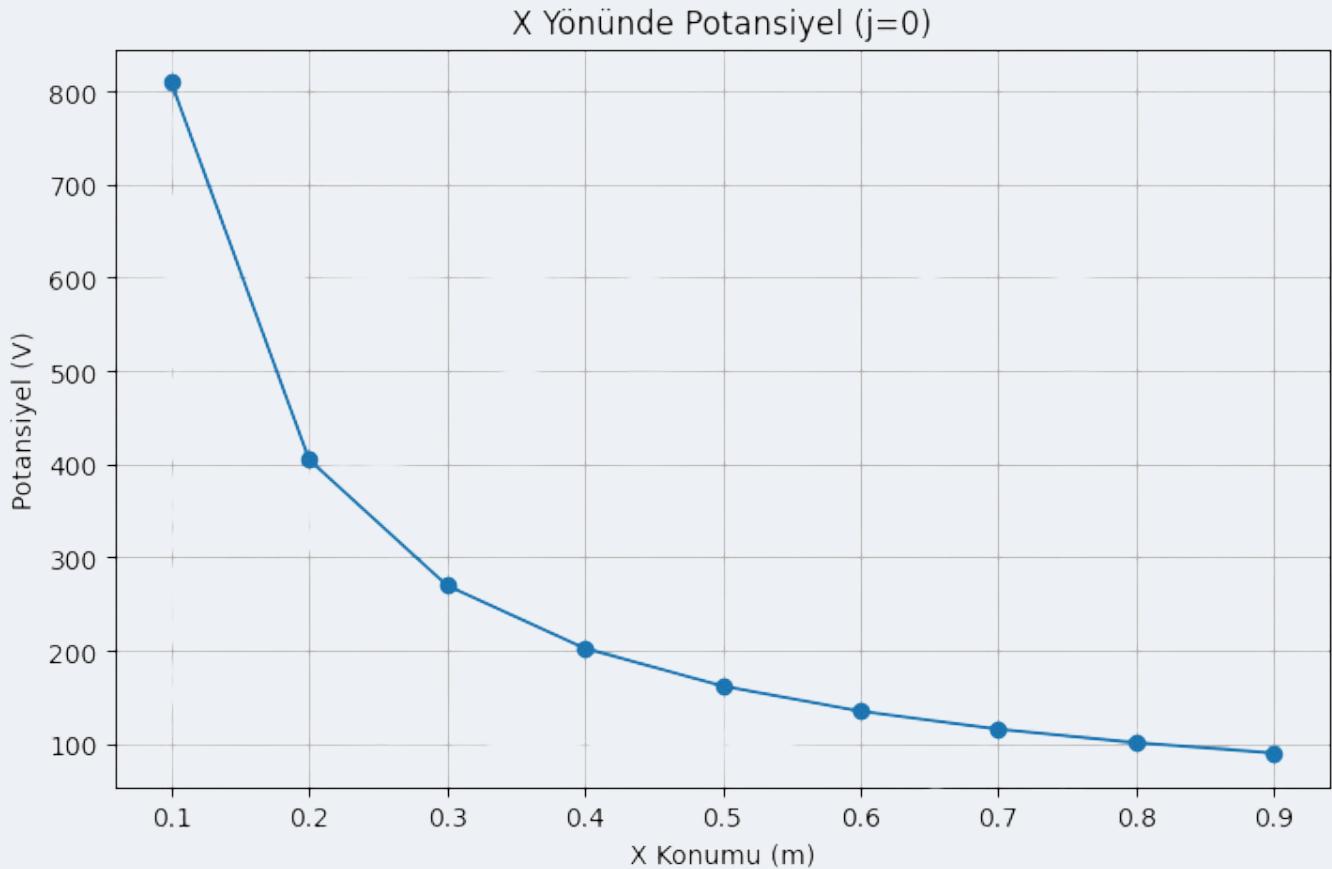
1)

c) Plot 2 dimensional image of the matrix by appropriate graphing tools.



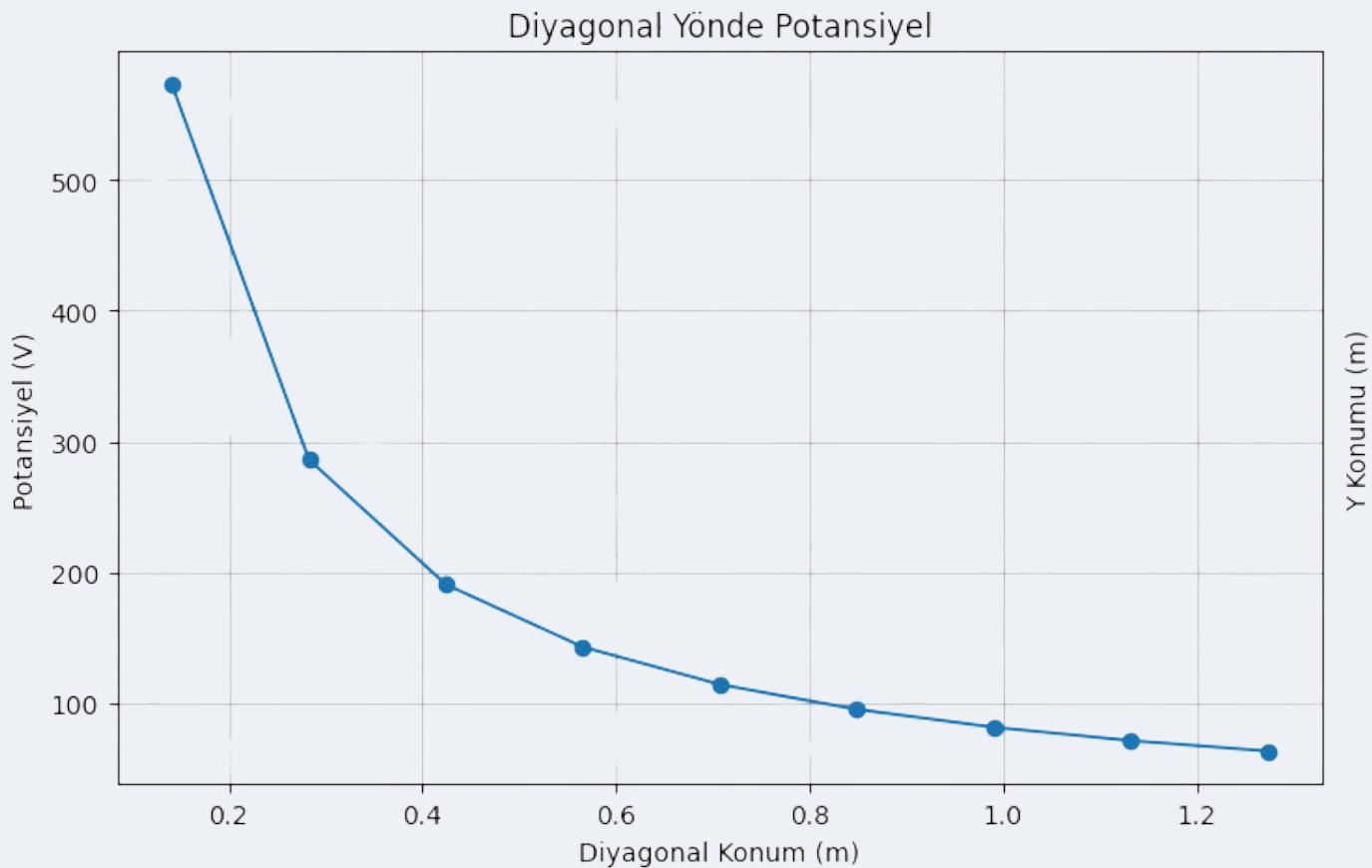
1)

d) Plot V for i=[1, 9] and j=0 x direction, V vs x



1)

e) Plot V for diagonal direction i;j =[1;1] to [9,9], V vs r (r is in diagonal direction)



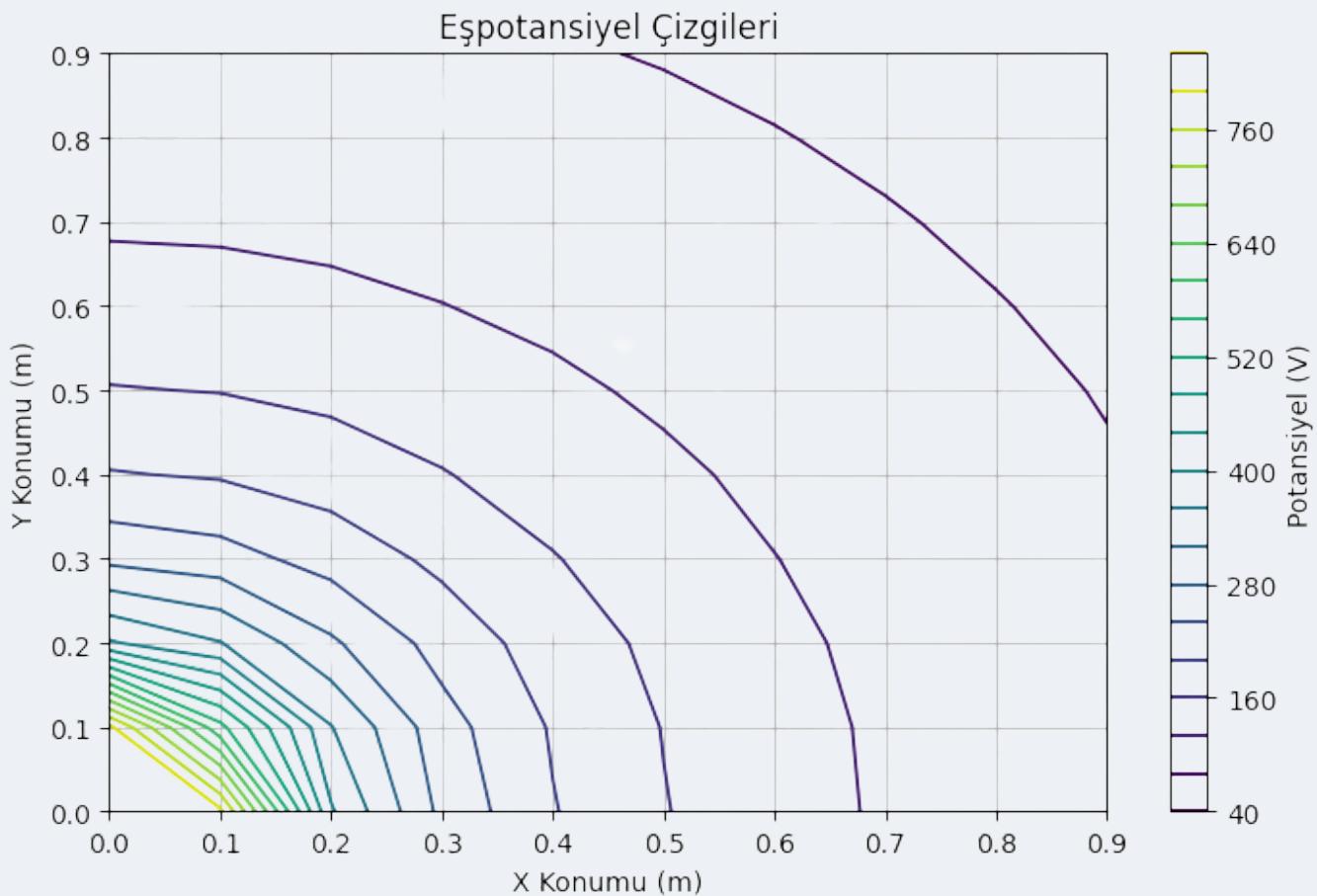
1)

f) On this data, which points have the same V potential value? Can you draw equipotential lines on the data? How would you change this problem, so that you can draw equipotential lines ?

$$A(a,b) = B(c,d) \quad \text{the distance between } X(i,j) \text{ and the charge is} > d = \sqrt{i^2 + j^2}$$

so, the points that provide equality $a^2 + b^2 = c^2 + d^2$ have the same V potential value.

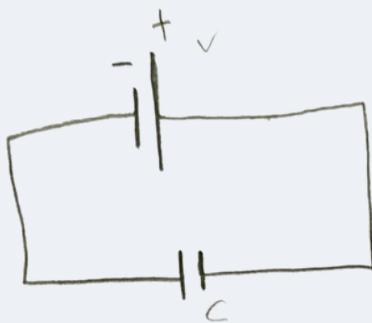
The equipotential lines:



2) 25p Use your programming skills to demonstrate / solve another problem from Physics II topics.

I made a program calculating the capacitance of the capacitor and the upper plate load by using the plate area, plate separation and voltage values.

First, I review the problem and created a path for solving solution on paper.



$$C = \epsilon_0 \cdot \frac{A}{d} \quad \text{Capacitance}$$

$$Q = C \cdot V \quad \text{Top Plate Charge}$$

$$A_m^2 = A_m^2 \times 10^{-6} \quad C_pF = C_F \times 10^{12}$$

$$dm = dm \times 10^{-3} \quad Q_pC = Q_C \times 10^{12}$$

Then, I wrote a code that calculate in java. Because I know Java, I don't know python yet.

```
J capacitor.java > ...
1
2
3 import java.util.Scanner;
4
5 public class capacitor {
6     // epsilon (F/m)
7     private static final double EPSILON_0 = 8.854e-12;
8
9     // Kapasitans hesaplama
10    public static double calculateCapacitance(double area, double separation) {
11        double area_m2 = area * 1e-6; // mm^2'yi m^2'ye dönüştür
12        double separation_m = separation * 1e-3; // mm'yi m'ye dönüştür
13        double capacitance = (EPSILON_0 * area_m2) / separation_m;
14        return capacitance * 1e12; // F'yi pF'ye dönüştür
15    }
16
17    // Üst plakada biriken yük yükü
18    public static double calculateCharge(double capacitance, double voltage) {
19        return capacitance * voltage; // Yük (pC)
20    }
21
22    Run | Debug
23    public static void main(String[] args) {
24        Scanner scanner = new Scanner(System.in);
25
26        System.out.print("Enter plate area (mm^2): ");
27        double area = scanner.nextDouble();
28
29        System.out.print("Enter separation (mm): ");
30        double separation = scanner.nextDouble();
31
32        System.out.print("Enter battery voltage (V): ");
33        double voltage = scanner.nextDouble();
34
35        // Kapasitans
36        double capacitance = calculateCapacitance(area, separation);
37
38        // Üst plaka yükü
39        double charge = calculateCharge(capacitance, voltage);
40
41        System.out.printf("Capacitance: %.2f pF\n", capacitance);
42        System.out.printf("Top Plate Charge: %.2f pC\n", charge);
43
44        scanner.close();
45    }
46}
```

I used ChatGPT for turn the code into python for plotting the graphs.

Here are the conversation:

The screenshot shows a ChatGPT interface. The user has pasted Java code into the input field. The code calculates capacitance based on area and separation, prints the results, and closes a scanner. Below the code, a message asks if the user wants to write it in Python. ChatGPT responds with a Python translation, which includes importing math, defining constants, and creating a calculate_capacitance function that follows the same logic as the Java code.

```
double capacitance = calculateCapacitance(area, separation);

// Üst plaka yükü
double charge = calculateCharge(capacitance, voltage);

System.out.printf("Capacitance: %.2f pF\n", capacitance);
System.out.printf("Top Plate Charge: %.2f pC\n", charge);

scanner.close();
}

}

bu kodu python dilinde yazar misin?
```

Tabii, verdığınız Java kodunu Python diline çevirebiliriz. İşte Python dilindeki eşdeğer kod:

```
python
import math

# Boşluğun elektriksel geçirgenliği (F/m)
EPSILON_0 = 8.854e-12

# Kapasitans hesaplama fonksiyonu
def calculate_capacitance(area, separation):
    area_m2 = area * 1e-6 # mm^2'yi m^2'ye dönüştürme
    separation_m = separation * 1e-3 # mm'yi m'ye dönüştürme
    capacitance = (EPSILON_0 * area_m2) / separation_m
    return capacitance * 1e12 # F'yi pF'ye dönüştürme
```

And I use ChatGPT again for plotting.

The user asks ChatGPT to create a Tkinter-based plotter. ChatGPT provides instructions on how to use track bars to change values and update the plot. It also provides the basic structure of the Python code for setting up the Tkinter window and defining the calculate_capacitance function.

plaka alanı, plaka seperation ve pilin voltajı. evet doğru bildin. 3 adet track bar olacak. daha sonra buradan değerler değişikçe, tabi değiştirdiğimiz değer yanında yazacak şekilde, capacitance değeri aşağıda değişecek. arkaplanda verdığın formüle göre hesaplayacak tabi

Anladım. Şimdi, plaka alanı, plaka ayrılığı ve pilin voltajı için 3 adet track bar içeren bir Tkinter arayüzü oluşturacağız. Bu track barlar değiştirilirken, seçilen değerler yanında gösterilecek ve kapasitans değeri formüle göre hesaplanarak aşağıda güncellenecek.

Başlangıç olarak temel bir Tkinter arayüzü oluşturup track barları ve kapasitans hesaplama fonksiyonunu ekleyeceğiz.

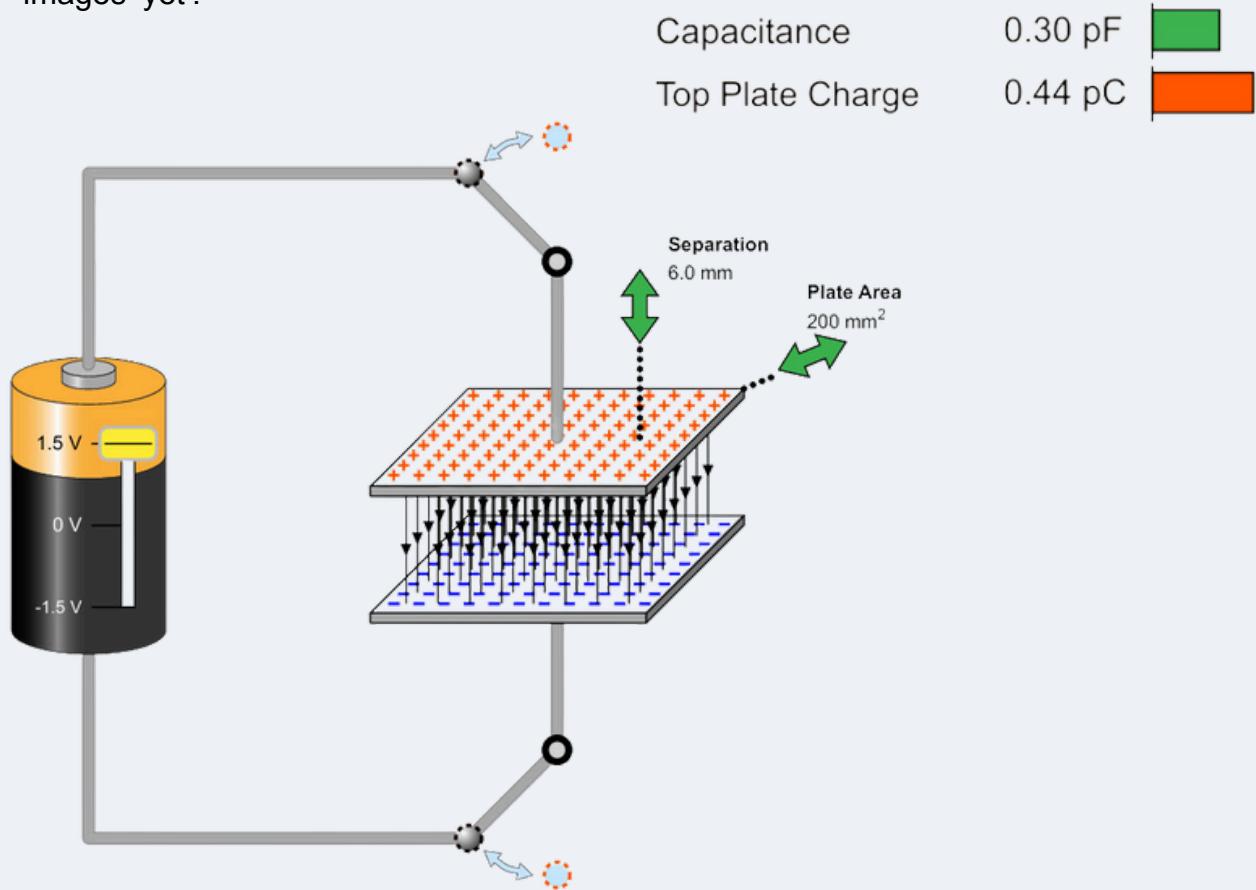
İşte kodun temel yapısı:

```
python
import tkinter as tk
from tkinter import ttk

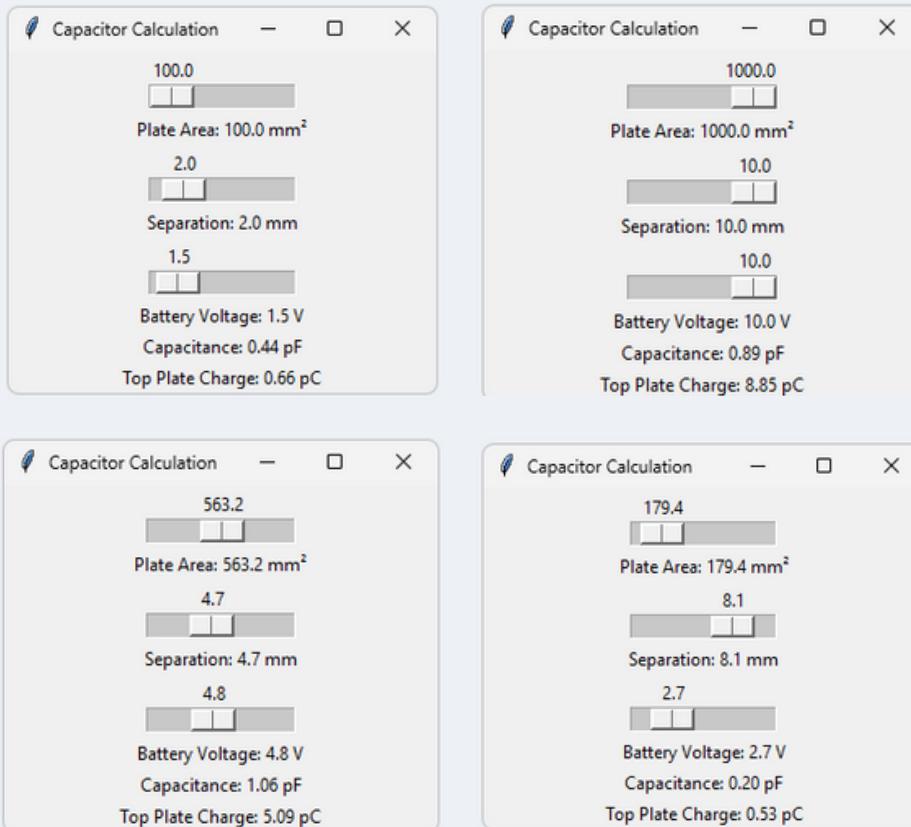
# Kapasitans hesaplama fonksiyonu
def calculate_capacitance(area, separation, voltage):
    epsilon_0 = 8.854e-12 # Boşluğun elektriksel geçirgenliği (F/m)
    area_m2 = area * 1e-6 # mm^2'yi m^2'ye dönüştürme
    separation_m = separation * 1e-3 # mm'yi m'ye dönüştürme
    capacitance = (epsilon_0 * area_m2) / separation_m
    return capacitance

# Track bar değerlerinin değişiminde çağrılan fonksiyon
def update_values():
```

This image is from [phet colorado](#) simulation. I made similar but I could not make with images 'yet'.



Here is my python program.



It is done here. All files is in available on [My GitHub Repositories.](#)

The screenshot shows a GitHub repository page. At the top, it displays the repository name 'ElectricPotential-Capacitance-Calc-Python-Java' and a 'Public' status. There are buttons for 'Pin', 'Unwatch', and a notification count of 1. Below this, there are dropdown menus for 'main' branch and '1 Branch', and a '0 Tags' button. A search bar with 'Go to file' and a 't' icon is followed by 'Add file' and 'Code' buttons. The commit history shows a single commit from 'efekurucay' updating 'README.md'. The file list includes '2024Phys2Hmwk1.pdf', 'README.md', 'capacitor.java', 'capacitor.py', 'electric_potential.java', 'electric_potential_calculation.py', and 'README'. The commits for each file are listed as 'update' with timestamps of 'now' or '6 minutes ago'. A 'README' link is highlighted in red at the bottom of the list.

Akdeniz University CSE-112-Physics-II Final Exam Homework Part

Hello, I am Yahya Efe Kuruçay.

I am a computer engineering student at Akdeniz University.

This repo contains the programming assignments I have completed in my Akdeniz University physics lectures.

The assignments are written in Java.

For more information about the content of the assignments and the technologies I used, please see the README files (generally there are pdf's in the folders) for the respective assignments.

I share this repo to leave a digital footprint on the internet. I don't know why, I just like it.

If you have any questions, please feel free to contact me at [my website](#).

Thank you. 2024.



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