PURDUE
UNIVERSITY

CS 180.2x

Holiday Project!

In this Java programming assignment, you will practice using all the tools that you learned about in the first 12 weeks of the course to help our special Holiday Present Delivering Robot, Scanner Claus, to deliver computing devices to all of the world's children.

I. Review the class **DeliveryMap** which is provided in its entirety to you in the file **DeliveryMap.java**. This class will be used to read in a map from a text file, and will feature the following symbols.
   a. 'S' – the starting position for Scanner Claus
   b. 'X' – an impassable obstacle
   c. 'C' – extra carrots for Scanner Claus' reindeers
   d. Numbers from 1-9 – locations for Scanner Claus to deliver presents to, in any order that it sees fit.

II. Design portions of a class called **ScannerClaus** in a file called **ScannerClaus.java**. This class will hold five instance variables, one constructor, and must define the methods described below. You may add any additional helper methods that you need in ScannerClaus to solve this problem.
   a. Review the **ScannerClaus** constructor, the **move** method and the **toString** method. Understanding how these work will help you to plan your algorithm for moving Scanner Claus on its route.
   b. Define the accessors **getNumCarrots**, **getNumPresents**, and **getPath**. The first two will simply return the corresponding integer values. The last accessor should return a String that consists of both the complete current **path** and the number of steps that Scanner Claus has taken thus far. A sample String appears below.

      ```
      "WWDDDDSD\nSteps: 8"
      ```

   c. Define the **chooseMove** method. This is an open-ended method that should employ an algorithm to select which direction to move given the current position of Scanner Claus and the details of the Delivery Map. This method will be called once per turn and should choose only the very next move to make. The goal is to complete Scanner Claus' deliveries using the fewest steps, and noting the limiting factor in the need for carrots to feed the reindeers.

III. The instance variables and constructor for **ScannerClaus** have been defined for you. A description of the instance variable appears below.
   a. The **numPresents** variable is an integer. It holds the number of presents that Scanner Claus has left to deliver and is based on the map.
   b. The **numCarrots** variable is an integer. It holds the number of carrots that you have to feed your reindeers. The reindeers will eat one carrot per move. This variable is initialized to five times the number of presents that Scanner Claus will need to deliver.
   c. The **x** and **y** variables are integers. These represent the coordinates of Scanner Claus on the map. Note that in a two-dimensional array in Java, what is considered the y in a traditional coordinate system corresponds with the row, and the x corresponds with the column.

d. The **path** variable is a String. This will contain the list of all moves (coded as key presses: W,A,S,D) made by Scanner Claus.

IV. Submit your **ScannerClaus.java** file using Vocareum. We will use our own DeliveryMap.java and HolidayRunner.java files to test your program. This means that your method signatures should be exactly as specified in this document.

Good luck!

DeliveryMap.java

```
import java.io.File;
import java.io.FileNotFoundException;
import java.util.Scanner;

public class DeliveryMap {
    private char map[][];
    private int rows;
    private int cols;
    private int numPresents;

    public DeliveryMap(String fileName) {
        Scanner s;
        try {
            s = new Scanner(new File(fileName));
            this.rows = s.nextInt();
            this.cols = s.nextInt();
            this.numPresents = s.nextInt();
            map = new char[rows][cols];
            String mapInput = s.nextLine();
            for (int r = 0; r < rows; r++) {
                mapInput = s.nextLine();
                for (int c = 0; c < cols; c++) {
                    map[r][c] = mapInput.charAt(c);
                }
            }
        } catch (Exception e) {
            System.err.print(e);
        }
    }

    public int getNumPresents()             {return numPresents;}

    public char getPosition(int r, int c)   {return map[r][c];}
```

```
    public boolean setPosition(int r, int c, boolean previous) {
        if (map[r][c] == 'X') {
            return false;
        } else if (previous){
            map[r][c] = '.';
        } else {
            map[r][c] = 'S';
        }
        return true;
    }

    public int[] find(char toFind) {
        int[] pos = new int[2];
        for (int r = 0; r < this.rows; r++) {
            for (int c = 0; c < this.cols; c++) {
                if (map[r][c] == toFind) {
                    pos[0] = r;
                    pos[1] = c;
                    return pos;
                }
            }
        }
        return pos;
    }

    public String printMap() {
        String out = "";
        for (char[] r : map) {
            for (char c : r) {
                out += c;
            }
            out += "\n";
        }
        return out;
    }
}
```

ScannerClaus.java

```
import java.util.Scanner;

public class ScannerClaus {
    private int numPresents;
    private int numCarrots;
    private int x,y;
    private String path;

    public ScannerClaus(DeliveryMap d) {
        this.numPresents = d.getNumPresents();
        this.numCarrots = 5*this.numPresents;
        int[] pos = d.find('S');
        this.x = pos[1];
        this.y = pos[0];
        this.path = "";
    }
```

```
    /** @return the number of carrots left for the reindeers */
    public int getNumCarrots();

    /** @return the number of presents left to deliver */
    public int getNumPresents();

    /** @return the list of selected moves as a single String with no spaces
     *          followed by a new line, "Steps: " and then the number of moves
     *          made.
     */
    public String getPath();

    /** Returns the character determining the next move for Scanner Claus
     * @param d the map Scanner Claus is navigating
     * @return the character representing the single next move for Scanner
     *          Claus to make in delivering all the presents
     */
    public char chooseMove(DeliveryMap d);

    public void move(DeliveryMap d, char dir) {
        int nextX = this.x;
        int nextY = this.y;

        switch(dir) {
            case 'W':
                nextY = this.y - 1;
                break;
            case 'A':
                nextX = this.x - 1;
                break;
            case 'S':
                nextY = this.y + 1;
                break;
            case 'D':
                nextX = this.x + 1;
                break;
            default:
                return;
        }

        char target = d.getPosition(nextY,nextX);
        if(target == 'C')
            this.numCarrots += 20;
        else if ((int)target > 48 && (int)target < 58)
            this.numPresents--;

        if(d.setPosition(nextY,nextX,false)) {
            d.setPosition(this.y,this.x,true);
            this.x = nextX;
            this.y = nextY;
            this.path += dir;
            this.numCarrots--;
        }
    }

    public String toString() {
        String msg = "Ho ho ho! (" + x + "," + y + ")\n";
        msg += "Carrots = " + this.numCarrots + "; Presents = " + this.numPresents + "\n";
        msg += "Press W (up), A (left), S (down), D (right), Q (quit)\n";
        return msg;
    }
}
```

HolidayRunner.java

```
import java.util.Scanner;

public class HolidayRunner {
    public static void main(String[] args) {
        DeliveryMap d = new DeliveryMap("maps/mapA.txt");
        ScannerClaus sc = new ScannerClaus(d);
        Scanner s = new Scanner(System.in);
        int playMode;
        char choice;

        System.out.println("Automate (1) or Play (2): ");
        playMode = s.nextInt();

        if (playMode == 1) {
            do {
                System.out.println(d.printMap());
                sc.move(d, sc.chooseMove(d));
            } while (sc.getNumCarrots() > 0 && sc.getNumPresents() > 0);
        } else {
            do {
                System.out.println(d.printMap());
                System.out.println(sc);
                choice = s.next().toUpperCase().charAt(0);
                sc.move(d, choice);
            } while (choice != 'Q' && sc.getNumCarrots() > 0 && sc.getNumPresents() > 0);
        }
        if (sc.getNumCarrots() == 0)
            System.out.println("Your reindeer ran out of carrots and refuse to keep going!");
        else if (sc.getNumPresents()==0)
            System.out.println("You delivered all of the presents! Ho ho!");
        System.out.println(sc.getPath());
    }
}
```

mapA.txt

```
14 22 6
XXXXXXXXXXXXXXXXXXXXXX
XS           C   X6  X
X     X2             X
X                XX  X
X  1        X       X
X     X     X     5   X
X           X         X
X           X    XX   X
X    C    4           X
X                     X
X   XXX             C X
X        3    XXXXX   X
X                     X
XXXXXXXXXXXXXXXXXXXXXX
```