Task 1 Soln

```
# Task 1.1

import random

rows = 6
cols = 6

# for loop to display
def displayMaze(maze):
    for i in range(rows):
        for j in range(cols):
            print(maze[i][j], end = ' ')
        print()
    print()


# open and close file
# create 2D array
def getMaze(maze):
    inpFile = open('MAZE.txt', 'r')
    for line in inpFile:
        line = list(line.rstrip())
        maze.append(line)
    inpFile.close()


# generate exit position
# update the maze
def createExit(maze):
    col = random.randint(1, cols-2)   # from 2nd col to 2nd last col
    maze[rows-1][col] = "."
    exitPos = {'y':rows-1, 'x':col}
    return exitPos

def main():
    maze = []
    getMaze(maze)
    exitPos = createExit(maze)
    displayMaze(maze)

main()
```

```
# # # # T #
# . # . . #
# . . . # #
# # . # . #
# . . . . #
# . # # # #
# Task 1.2

def getDirection():
    newD = input("Enter direction ('U','D','L','R',''): ").upper()
    valid = ['U','D','L','R','']
    while newD not in valid:
        print('Invalid direction! Try again!')
        newD = input("Enter user direction ('U','D','L','R',''):
").upper()
    return newD


def moveRobot(maze, robot, newD, steps):
    newY, newX = robot['y'], robot['x']
    if newD == 'L':
        newX -= 1
    elif newD == 'R':
        newX += 1
    elif newD == 'U'and newY > 0:
        newY -= 1
    elif newD == 'D':
        newY += 1
    # if newD == '', do nothing

    if maze[newY][newX] == '.':
        steps += 1
        maze[robot['y']][robot['x']] = 'X'
        maze[newY][newX] = 'T'
        robot['y'], robot['x'] = newY, newX
    else:
        print ("Can't go there!\n")

    return steps


def main():
    maze = []
    getMaze(maze)
    exitPos = createExit(maze)
    displayMaze(maze)

    # initialization
    robot = {'y':0, 'x':4}
    atExit = False
    steps = 0
    prevD = ""

    while not atExit:
        newD = getDirection()
        if newD == "":
            newD = prevD

        steps = moveRobot(maze, robot, newD, steps)
        if robot == exitPos:
            atExit = True
        else:
            prevD = newD

        displayMaze(maze)

    print (f"The robot takes {steps} moves to exit the maze.")

main()
```

```

# # # # T #
# . # . . #
# . . . # #
# # . # . #
# . . . . #
# # # # . #

Enter direction ('U','D','L','R',''): D
# # # # X #
# . # . T #
# . . . # #
# # . # . #
# . . . . #
# # # # . #

Enter direction ('U','D','L','R',''): R
Can't go there!

# # # # X #
# . # . T #
# . . . # #
# # . # . #
# . . . . #
# # # # . #

Enter direction ('U','D','L','R',''): L
# # # # X #
# . # T X #
# . . . # #
# # . # . #
# . . . . #
# # # # . #

Enter direction ('U','D','L','R',''): D
# # # # X #
# . # X X #
# . . T # #
# # . # . #
# . . . . #
# # # # . #
```

```
Enter direction ('U','D','L','R',''): L
# # # # X #
# . # X X #
# . T X # #
# # . # . #
# . . . . #
# # # # . #

Enter direction ('U','D','L','R',''): D
# # # # X #
# . # X X #
# . X X # #
# # T # . #
# . . . . #
# # # # . #

Enter direction ('U','D','L','R',''):
# # # # X #
# . # X X #
# . X X # #
# # X # . #
# . T . . #
# # # # . #

Enter direction ('U','D','L','R',''): R
# # # # X #
# . # X X #
# . X X # #
# # X # . #
# . X T . #
# # # # . #

Enter direction ('U','D','L','R',''):
# # # # X #
# . # X X #
# . X X # #
# # X # . #
# . X X T #
# # # # . #

Enter direction ('U','D','L','R',''): D
# # # # X #
# . # X X #
# . X X # #
# # X # . #
# . X X X #
# # # # T #

The robot takes 9 moves to exit the maze.
```

Task 2 Soln:

```
#Task2_1

class Person:
    def __init__(self, name, age):
        self._name=name
        self._age=age

    def getName(self):
        return self._name

    def getAge(self):
        return self._age

    def print(self):
        print (f"{self._name}, {self._age}")
```

```
#Task2_2

def task2_2(filename):
    lst=[]

    f = open(filename, 'r')
    for line in f:
        name, age= line.split(',')
        lst.append(Person(name.strip(), int(age.strip())))
    f.close()

    return lst

#print(task2_2('person.txt'))

list_of_person = task2_2('PERSON.txt')
for person in list_of_person:
    person.print()
```

```
Alice, 18
Bob, 20
Charlie, 17
David, 16
Emily, 19
Austin, 19
Cole, 20
Adam, 16
Benjamin, 16
Chloe, 19
Daniel, 19
Eva, 20
Bailey, 18
Daisy, 18
Amelia, 17
Brian, 19
Catherine, 18
Dylan, 17
Eleanor, 16
```

```
Bella, 17
Caleb, 16
Delilah, 20
Ethan, 17
Ella, 18
Arthur, 20
```

```
# Task2_3 insertion sort

def task2_3(list_of_person, key, order):

    n=len(list_of_person)

    for i in range(1, n):

        target = list_of_person[i]
        j = i-1

        if key =="name":
            if order =='asc':
                while j >= 0 and
                     (target.getName() < list_of_person[j].getName()):
                    list_of_person[j+1] = list_of_person[j]
                    j -= 1
            else:
                while j >= 0 and
                        (target.getName() > list_of_person[j].getName()):
                    list_of_person[j+1] = list_of_person[j]
                    j -= 1

        elif key =="age":
            if order=='asc':
                while j >= 0 and
                        (target.getAge() < list_of_person[j].getAge()):
                    list_of_person[j+1] = list_of_person[j]
                    j -= 1
            else:
                while j >= 0 and
                        (target.getAge() > list_of_person[j].getAge()):
                    list_of_person[j+1] = list_of_person[j]
                    j -= 1

        list_of_person[j+1] = target


list_of_person=task2_2('PERSON.txt')
task2_3(list_of_person, 'name', 'asc')
for person in list_of_person:
    person.print()
```

```
Adam, 16
Alice, 18
Amelia, 17
Arthur, 20
Austin, 19
Bailey, 18
```

```
Bella, 17
Benjamin, 16
Bob, 20
Brian, 19
Caleb, 16
Catherine, 18
Charlie, 17
Chloe, 19
Cole, 20
Daisy, 18
Daniel, 19
David, 16
Delilah, 20
Dylan, 17
Eleanor, 16
Ella, 18
Emily, 19
Ethan, 17
Eva, 20
```

```
# Task2_4
#Quicksort

def quicksort(list_of_person, low, high, key, order):
    # perform a recursive quicksort
    # sorting the range [low,high], inclusive of both ends

    if low < high:   # list has more than one element
        # partition into two sublists, pos is partitioning index
        pos = partition(list_of_person, low, high, key, order)

        # separately sort elements before partition and after partition
        quicksort(list_of_person, low, pos-1, key, order)
        quicksort(list_of_person, pos+1, high, key, order)

    # else list has 0 or 1 element and requires no sorting


def partition(list_of_person, low, high, key, order):
    # partition list into two sublists
    # re-arrange the list so that the pivot is properly partitioned

    i =  low   # boundary index
    pivot = list_of_person[high]

    for j in range(low, high):

        # if current element is smaller than the pivot, move it to the left
        if key == 'name':
            if order == 'asc':
                if list_of_person[j].getName() < pivot.getName():
                    list_of_person[i], list_of_people[j]
                        = list_of_person[j], list_of_person[i]
                    #swap cur element with the element at boundary index
                    i = i + 1      # increment boundary index
            else:
                if list_of_person[j].getName() > pivot.getName():
                    list_of_person [i], list_of_person[j]
                        = list_of_person[j], list_of_person[i]
                    #swap cur element with the element at boundary index
                    i = i + 1      # increment boundary index

        elif key == 'age':
            if order == 'asc':
                if list_of_person[j].getAge() < pivot.getAge():
                    list_of_person[i], list_of_person[j]
                        = list_of_person[j], list_of_person[i]
                    #swap cur element with the element at boundary index
                    i = i + 1      # increment boundary
            else:
                if list_of_person[j].getAge() > pivot.getAge():
                    list_of_person[i], list_of_person[j]
                        = list_of_person[j], list_of_person[i]
                    # swap cur element with the element at boundary index
                    i = i + 1      # increment boundary index

    # end of FOR loop; place pivot in the correct position at index i
    list_of_person[i], list_of_person[high]
         = list_of_person[high], list_of_person[i]
    return i       # final position of pivot


def task2_4(list_of_person, key, order):
    quicksort(list_of_person, 0, len(list_of_person)-1, key, order)


list_of_person=task2_2('PERSON.txt')
task2_4(list_of_person, 'age', 'desc')
for person in list_of_person:
    person.print()
```

```
Arthur, 20
Delilah, 20
Bob, 20
Eva, 20
Cole, 20
Emily, 19
Chloe, 19
Daniel, 19
Austin, 19
Brian, 19
Alice, 18
Ella, 18
Bailey, 18
Daisy, 18
Catherine, 18
Charlie, 17
Amelia, 17
Dylan, 17
```

```
Bella, 17
Ethan, 17
Benjamin, 16
Caleb, 16
David, 16
Eleanor, 16
Adam, 16
```

```
#Task 2.5

def task2_5(list_of_person, method, key, order):
    if method=='insertion sort':
       task2_3(list_of_person, key, order)
    elif method=='quick sort':
       task2_4(list_of_person, key, order)


list_of_person=task2_2('PERSON.txt')
task2_5(list_of_person,'quick sort','name','desc')
for person in list_of_person:
    person.print()
```

```
Eva, 20
Ethan, 17
Emily, 19
Ella, 18
Eleanor, 16
Dylan, 17
Delilah, 20
David, 16
Daniel, 19
Daisy, 18
Cole, 20
Chloe, 19
Charlie, 17
Catherine, 18
Caleb, 16
Brian, 19
Bob, 20
Benjamin, 16
Bella, 17
Bailey, 18
Austin, 19
Arthur, 20
Amelia, 17
Alice, 18
Adam, 16
```

Task 3 Soln:

```
# Task 3.1
```

```
class Player:
    def __init__(self, name, elo, pointer):
        self.name = name
        self.elo = elo
        self.ptr = pointer


class PlayerList:
    def __init__(self, n):
        self.head = -1
        self.free = 0
        self.data = [None] * n
        for i in range(n-1):
            self.data[i] = Player('-',-1,i+1)
        self.data[n-1] = Player('-',-1,-1)


    def size(self):
        counter = 0
        ptr = self.head
        while ptr != -1:
            counter += 1
            ptr = self.data[ptr].ptr
        return counter


    def register(self, name, elo):
        if self.free == -1:
            print(f"Teams are full, unable to register {name}.")
            return

        elo = int(elo)
        curr = self.head
        prev = -1

        while curr != -1 and self.data[curr].elo > elo:
            prev = curr
            curr = self.data[curr].ptr

        new = self.free
        self.free = self.data[self.free].ptr
        self.data[new].name = name
        self.data[new].elo = elo

        if prev == -1:    # adding to front
            self.head = new
        else:
            self.data[prev].ptr = new

        self.data[new].ptr = curr   # adding general case




    def withdraw(self, name):
        ptr = self.head
        prev = -1
        while ptr != -1 and self.data[ptr].name != name:
            prev = ptr
            ptr = self.data[ptr].ptr

        if ptr == -1:
            print(f"{name} not found.")
        else:
            self.data[ptr].name = "-"
            self.data[ptr].elo = -1
            if prev == -1:
                self.head = self.data[ptr].ptr   # removing head
            else:
                self.data[prev].ptr = self.data[ptr].ptr  # for general case
            self.data[ptr].ptr = self.free
            self.free = ptr    #  manage free space


    def display(self):
        print(f"Head: {self.head},  Free: {self.free}")
        print(f"idx {'player name':^13} {'elo':^5} {'ptr':^3}")
        cap = len(self.data)
        for i in range(cap):
            print(f"{i:>2}: {self.data[i].name:^13} {self.data[i].elo:>5}
{self.data[i].ptr:>3}")
```

```
# Task 3.2

import csv

cteam = PlayerList(7)

f = open('CHESS.csv','r')
data = csv.reader(f)
for person in data:
    name, elo = person
    cteam.register(name,int(elo))
f.close()

print()
cteam.display()
print()
cteam.withdraw('Taylor')
print('Size:',cteam.size())
print()
cteam.display()
```

```
Teams are full, unable to register Kim.
Teams are full, unable to register Adele.
```

```
Head: 4,   Free: -1
idx  player name   elo  ptr
 0:     Nicki      1250   3
 1:     Lisa       1337   0
 2:     Iggy        828   5
 3:    Taylor      1109   6
 4:     Missy      1437   1
 5:     Megan       745  -1
 6:     Cardi       962   2

Size: 6

Head: 4,   Free: 3
idx  player name   elo  ptr
 0:     Nicki      1250   6
 1:     Lisa       1337   0
 2:     Iggy        828   5
 3:       -          -1  -1
 4:     Missy      1437   1
 5:     Megan       745  -1
 6:     Cardi       962   2
```

Task 4 soln:

```
# Task 4.1

import sqlite3
conn = sqlite3.connect('STORE.db')

# for debugging
conn.execute('DROP TABLE IF EXISTS Donut')
conn.execute('DROP TABLE IF EXISTS Member')
conn.execute('DROP TABLE IF EXISTS Sale')

conn.execute("CREATE TABLE Donut ( \
                DonutID INTEGER UNIQUE PRIMARY KEY, \
                DonutName TEXT, \
                UnitPrice REAL)")
conn.execute("CREATE TABLE Member ( \
                MemberNumber INTEGER UNIQUE PRIMARY KEY, \
                MemberName TEXT, \
                Phone TEXT)")
conn.execute("CREATE TABLE Sale ( \
                SaleID INTEGER UNIQUE PRIMARY KEY, \
                MemberNumber INTEGER, \
                DonutID INTEGER, \
                Date TEXT, \
                Quantity INTEGER, \
                FOREIGN KEY(MemberNumber) REFERENCES Member(MemberNumber), \
                FOREIGN KEY(DonutID) REFERENCES Donut(DonutID))")
conn.commit()
conn.close()
```

```
# Task 4.2

import sqlite3
conn = sqlite3.connect('STORE.db')

f = open('DONUT.txt', 'r')
for line in f:
    DonID, DonName, Price = line.strip().split(',')
    conn.execute("INSERT INTO Donut(DonutID, DonutName, UnitPrice) \
                    VALUES (?,?,?)", (int(DonID), DonName, float(Price)))
f.close()

f = open('MEMBER.txt', 'r')
for line in f:
    MemNum, MemName, Phone = line.strip().split(',')
    conn.execute("INSERT INTO Member(MemberNumber, MemberName, Phone) \
                    VALUES (?,?,?)", (int(MemNum), MemName, Phone))
f.close()

f = open('SALE.txt', 'r')
for line in f:
    SaleID, MemNum, DonID, Date, Quantity = line.strip().split(',')
    conn.execute("INSERT INTO Sale(SaleID, MemberNumber, DonutID, \
    Date, Quantity) VALUES (?,?,?,?,?)", \
    (int(SaleID), int(MemNum), int(DonID), Date, int(Quantity)))
f.close()
conn.commit()
conn.close()
```

```
# Task 4.3

import sqlite3
conn = sqlite3.connect('STORE.db')

number = input("Please enter member's number:")
query = "SELECT MemberName FROM Member WHERE MemberNumber = ?"
cursor = conn.execute(query, (number, ))
print('Orders by', cursor.fetchone()[0])

query = "SELECT Donut.DonutName, Sale.Date, Sale.Quantity \
            FROM Sale INNER JOIN Donut ON Donut.DonutID = Sale.DonutID \
            INNER JOIN Member ON Member.MemberNumber = Sale.MemberNumber \
            WHERE Member.MemberNumber = ? "
cursor = conn.execute(query, (number,))

print('Donut Name \t Date \t Quantity')
for result in cursor:
    print(f"{result[0]} \t {result[1]} \t {result[2]}")
conn.close()
```

```
Please enter member's number:104
Orders by Calvin
Donut Name      Date    Quantity
Ping Straberry   20230720       3
Ping Classic    20230721        2
Plain Cruller   20230721        1
Ping Straberry   20230723       3
Sugar Cruller   20230726        3
```

```
Plain Cruller   20230726        1
```

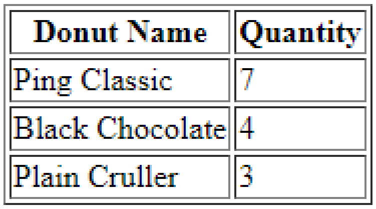
```
# Task 4.4

import sqlite3, flask
from flask import render_template, request
app = flask.Flask(__name__)

@app.route('/', methods = ['GET', 'POST'])
def index():
    if request.method == 'GET':
        return render_template('form.html')
    else:
        date = request.form['date']
        conn = sqlite3.connect('STORE.db')
        cursor = conn.execute("SELECT Donut.DonutName, SUM(Sale.Quantity) \
                                FROM Sale INNER JOIN Donut \
                                ON Sale.DonutID = Donut.DonutID \
                                WHERE Sale.Date = ? \
                                GROUP BY Donut.DonutID \
                                ORDER BY SUM(Sale.Quantity) DESC", (date, ))
        results = []
        for result in cursor:
            results.append(result)
        conn.close()
        return render_template('display.html', results = results)

if __name__ == '__main__':
    app.run()
```

```
<!DOCTYPE html>
<html>
        <head><title>Summary of Order by Date</title></head>
        <body>
                <table border = 1px>
                        <tr>
                                <th>Donut Name</th>
                                <th>Quantity</th>
                        </tr>

                        {% for row in results %}
                                <tr>
                                        <td>{{row[0]}}</td>
                                        <td>{{row[1]}}</td>
                                </tr>
                        {% endfor %}
                </table>
        </body>
</html>
```

```
<!DOCTYPE html>

<html>
        <head><title>Order Form</title></head>
        <body>
            <form method = 'post'>
```

```
                <h1>Please enter the date in numerical form of yyyymmdd:</h1>
                <h3><i>For example, enter 20230701 for 2023 July 1</i></h3>
                <p><input name = 'date'></p>
                <p><input type = 'submit'></p>
            </form>
        </body>
</html>
```

HTML Output



Donut Name	Quantity
Ping Classic	7
Black Chocolate	4
Plain Cruller	3