Pseudo Code

we know $C_n = \begin{cases} 1 & \text{if } n=0 \\ \frac{4n-2}{n+1} C_{n-1} & \text{if } n>0 \end{cases}$

Exercise 2.13 a)

```
# Define the function that calculates Cn

def Catalan(n):
    if n == 0
        return 1
    else
        return (4.n - 2/n+1).Catan(n-1) <- using the formula
print (Catalan(100)) <- to print C100
```

Exercise 3.1

```
# First we write a program that reads the data & makes a graph

Data = loadtxt ("sunspots.txt", float)   # Gets the file

x = data [:1000, 0] # month
y = data [:1000, 1] # Sunspot number
                    #chooses the columns
                    # & it displays only the first
                    # 1000 data point

r = 5
y_aveg = np.zeros (y)
```

```
# Next Calculate the running avg for the data
for i in range (r, len(y)-r):
    y_aveg[i] = 1/(2*r+1) * np.sum(y[i-r:i+r+1])

# Make the plot
plt.xlabel()
plt.ylabel()
plt.plot(x, y)
plt.plot(y_aveg)
plt.title()
plt.legend()
plt.show()
```

Exercise 3.2

```
# Write a program that reads the file & creates a density plot

data = loadtxt('stm.txt', float)
plt.imshow(data, ....)   # to create the density plot
gray()#since for this file, that is the best color scheme (easier to understand)
plt.title()
plt.show()
```