Universidad Politécnica Salesiana

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Materia: Simulación

Enunciado:

- Diseñe y desarrolle un modelo y/o script que permita simular el siguiente caso real: ◦ Se tiene los datos del ecuador (https://github.com/andrab/ecuacovid/tree/master/datos_crudos). En base a ello obtener los siguientes modelos:
  - `Generar graficas para entender y procesar los datos:`
    - `Generar graficas y reportes del total de personas  vacunadas.`

In [1]:

```
#importar las librerias necesarias
import matplotlib.pyplot as plt
import matplotlib.lines as mlines
import numpy as np
import pandas as pd
```

In [2]:

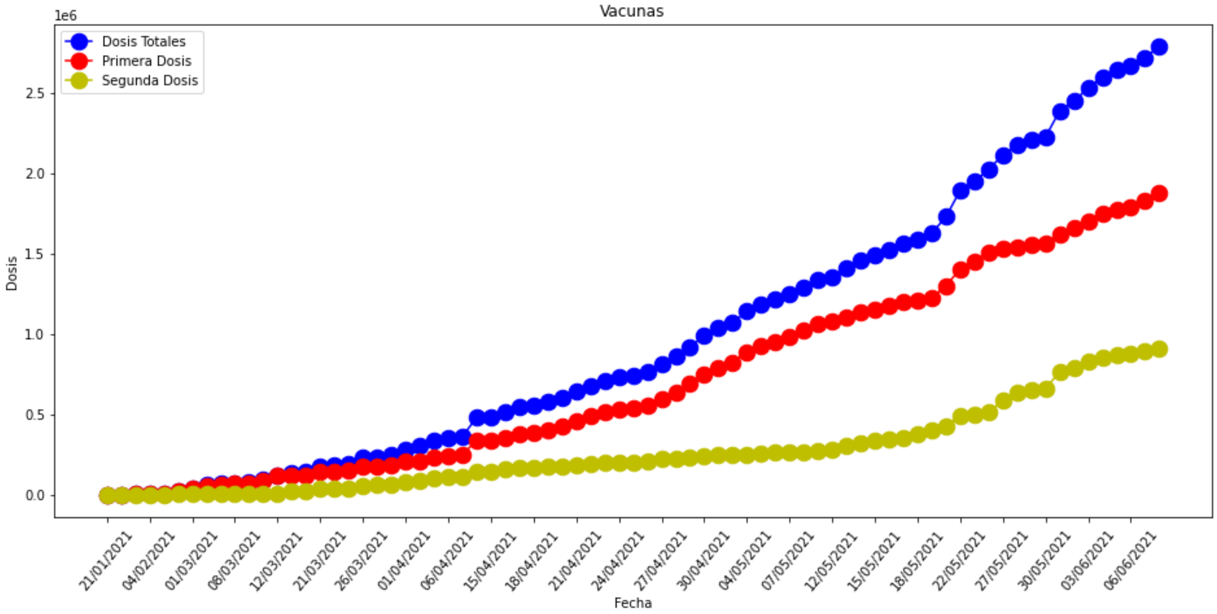
```
vacunas = pd.read_csv('vacunas.csv')
#imprimir los primeros 5 datos del archivo
vacunas.head(5)
```

Out[2]:

	fecha	dosis_total	primera_dosis	segunda_dosis
0	21/01/2021	0	0	0
1	22/01/2021	108	108	0
2	27/01/2021	2982	2982	0
3	04/02/2021	6228	6228	0
4	17/02/2021	8190	6228	1962

In [3]:

```
plt.figure(figsize=(16,7))

plt.title('Vacunas')

plt.plot(vacunas.fecha, vacunas.dosis_total, 'b.-', markersize=25,label='Dosis Total
plt.plot(vacunas.fecha, vacunas.primera_dosis, 'r.-', markersize=25, label='Primera
plt.plot(vacunas.fecha, vacunas.segunda_dosis, 'y.-', markersize=25, label='Segunda

plt.xticks(vacunas.fecha[::3].tolist())

plt.xlabel('Fecha')
plt.xticks(rotation=50)
plt.ylabel('Dosis')
plt.legend()
plt.show()
```



In [4]:

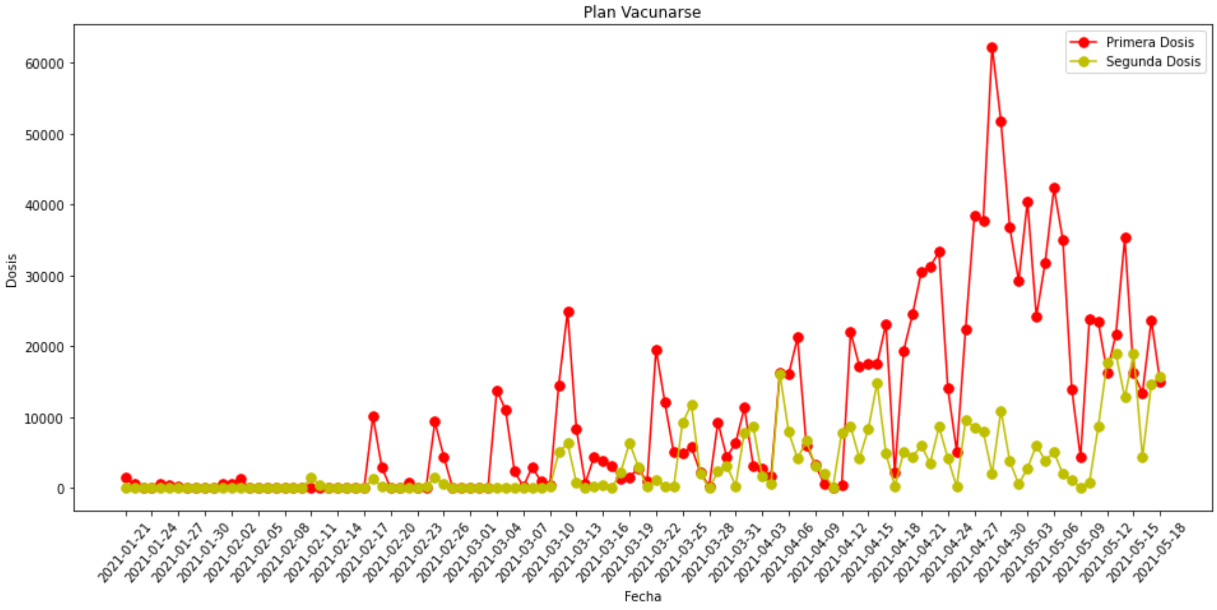
```
vacunas_planvacunarse = pd.read_csv('vacunas_planvacunarse.csv')
#imprimir los primeros 5 datos del archivo
vacunas_planvacunarse.head(5)
```

Out[4]:

	fecha	primera_dosis	segunda_dosis
0	2021-01-21	1500	0
1	2021-01-22	539	1
2	2021-01-23	31	0
3	2021-01-24	0	0
4	2021-01-25	622	0

In [5]:

```
plt.figure(figsize=(16,7))

plt.title('Plan Vacunarse')


plt.plot(vacunas_planvacunarse.fecha, vacunas_planvacunarse.primera_dosis, 'r.-', ma
plt.plot(vacunas_planvacunarse.fecha, vacunas_planvacunarse.segunda_dosis, 'y.-', ma

plt.xticks(vacunas_planvacunarse.fecha[::3].tolist())

plt.xlabel('Fecha')
plt.xticks(rotation=50)
plt.ylabel('Dosis')
plt.legend()
plt.show()
```



In [6]:

```
#Trabajar con datos en formato .csv
fabricantes = pd.read_csv('fabricantes.csv',sep=',')
#imprimir los primeros 5 datos del archivo
fabricantes.head(18)
```

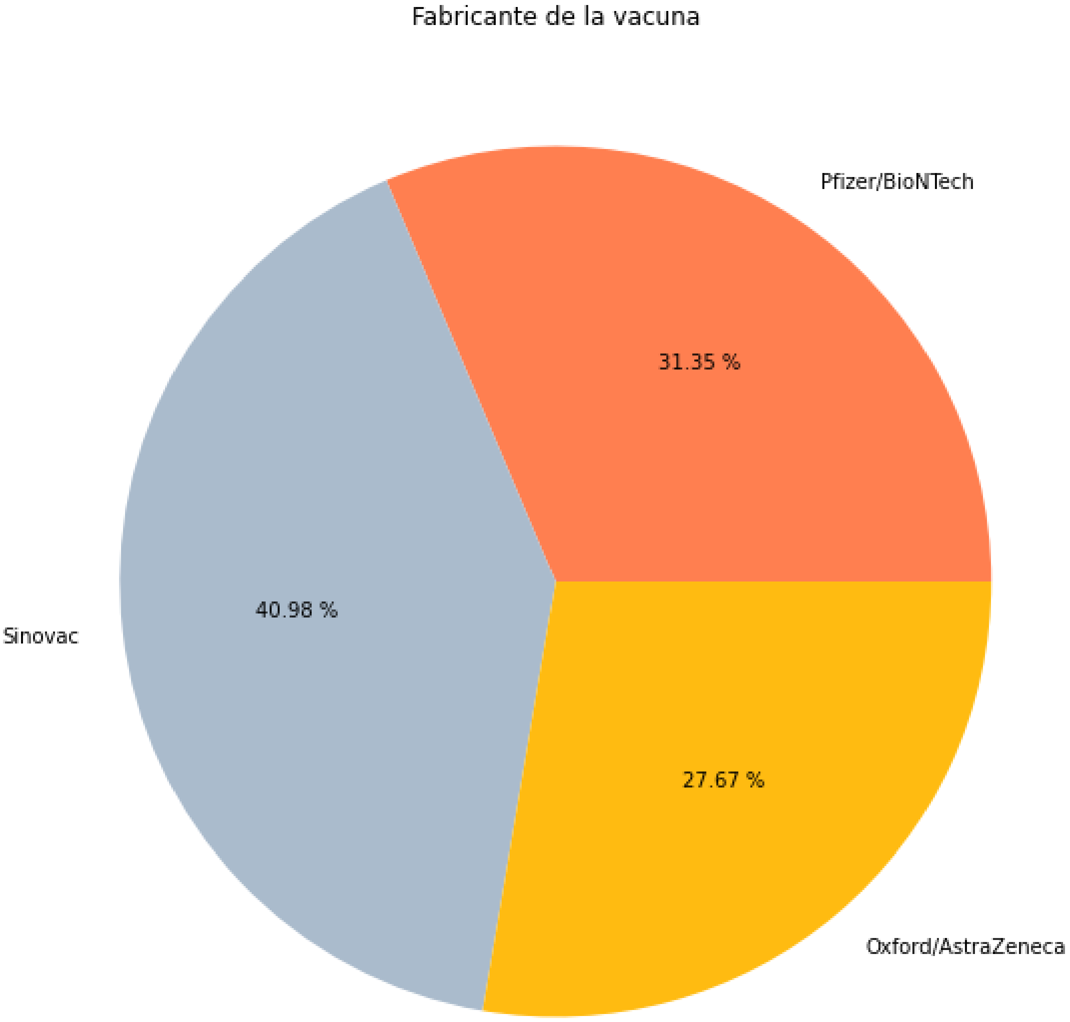
Out[6]:

	vaccine	total	arrived_at	contract
0	Pfizer/BioNTech	8190	20/01/2021	Government of Ecuador with Pfizer
1	Pfizer/BioNTech	16380	17/02/2021	Government of Ecuador with Pfizer
2	Pfizer/BioNTech	17550	24/02/2021	Government of Ecuador with Pfizer
3	Pfizer/BioNTech	31590	03/03/2021	Government of Ecuador with Pfizer
4	Sinovac	20000	06/03/2021	Donation from the Government of Chile to the G...
5	Pfizer/BioNTech	73710	10/03/2021	Government of Ecuador with Pfizer
6	Oxford/AstraZeneca	84000	17/03/2021	Government of Ecuador with COVAX
7	Pfizer/BioNTech	62010	17/03/2021	Government of Ecuador with Pfizer
8	Pfizer/BioNTech	65520	24/03/2021	Government of Ecuador with Pfizer
9	Pfizer/BioNTech	66690	31/03/2021	Government of Ecuador with Pfizer
10	Pfizer/BioNTech	53820	05/04/2021	Government of Ecuador with Pfizer
11	Sinovac	300000	07/04/2021	Government of Ecuador with Sinovac
12	Sinovac	700000	10/04/2021	Government of Ecuador with Sinovac
13	Pfizer/BioNTech	53820	14/04/2021	Government of Ecuador with Pfizer
14	Pfizer/BioNTech	54990	21/04/2021	Government of Ecuador with Pfizer
15	Oxford/AstraZeneca	336000	24/04/2021	Government of Ecuador with COVAX
16	Pfizer/BioNTech	54990	28/04/2021	Government of Ecuador with Pfizer
17	Pfizer/BioNTech	100620	04/05/2021	Government of Ecuador with Pfizer

In [7]:

```
# Generar un grafico de cual es su pie diestro
aux = 0
aux1 = 0
aux2 = 0
vaccine1 = fabricantes.loc[fabricantes.vaccine == 'Pfizer/BioNTech']['total']
```

```
for i in vaccine1:
    aux = aux+i

vaccine2 = fabricantes.loc[fabricantes.vaccine == 'Sinovac']['total']
for i in vaccine2:
    aux1 = aux1+i

vaccine3 = fabricantes.loc[fabricantes.vaccine == 'Oxford/AstraZeneca']['total']
for i in vaccine3:
    aux2 = aux2+i

plt.figure(figsize=(10,10))

etiquetas = ['Pfizer/BioNTech', 'Sinovac','Oxford/AstraZeneca']
colores = ['#ff7f50', '#aabbcc','#ffbb11']
plt.pie([aux,aux1,aux2], labels=etiquetas, colors=colores, autopct='%.2f %%')
plt.title('Fabricante de la vacuna')
plt.show()
```



In [8]:
```
sumaTotalVacunas = aux + aux1 +aux2
print(sumaTotalVacunas)
```

```
4206189
```

In [9]:
```
fabricantes['arrived_at'] = pd.to_datetime(fabricantes['arrived_at'], format='%d/%m/

font = {'family': 'serif',
        'color':  'darkred',
        'weight': 'normal',
        'size': 16,
        }
j = 1000
```

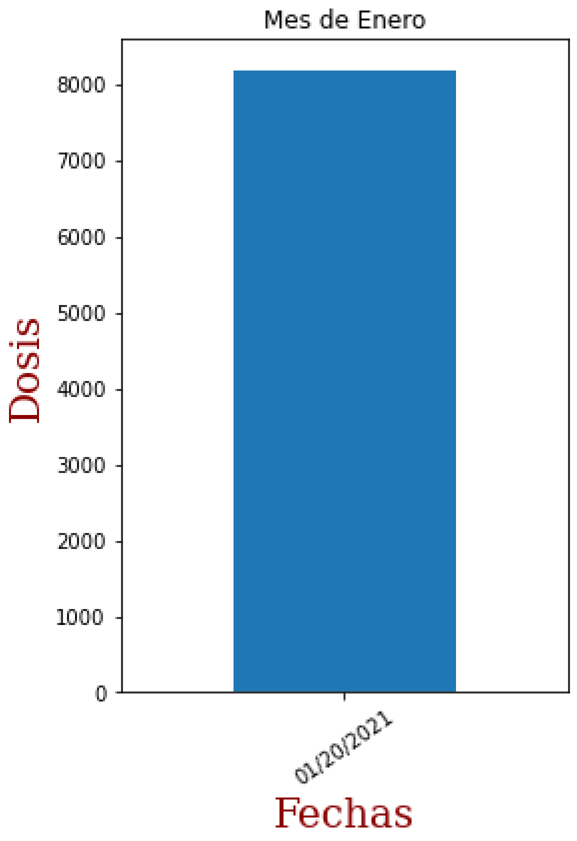
In [10]:

```
listae =[]
listae1 =[]
listae2 =[]

enero = fabricantes.loc[fabricantes.arrived_at.dt.month == 1]

for i in enero['arrived_at']:
    date_time = i
    d = date_time.strftime("%m/%d/%Y")
    listae.append(d)
print(listae)

for i in enero['total']:
    listae1.append(int(i))
print(listae1)

for i in enero['vaccine']:
    listae2.append((i))
print(listae2)
```

```
['01/20/2021']
[8190]
['Pfizer/BioNTech']
```

In [11]:

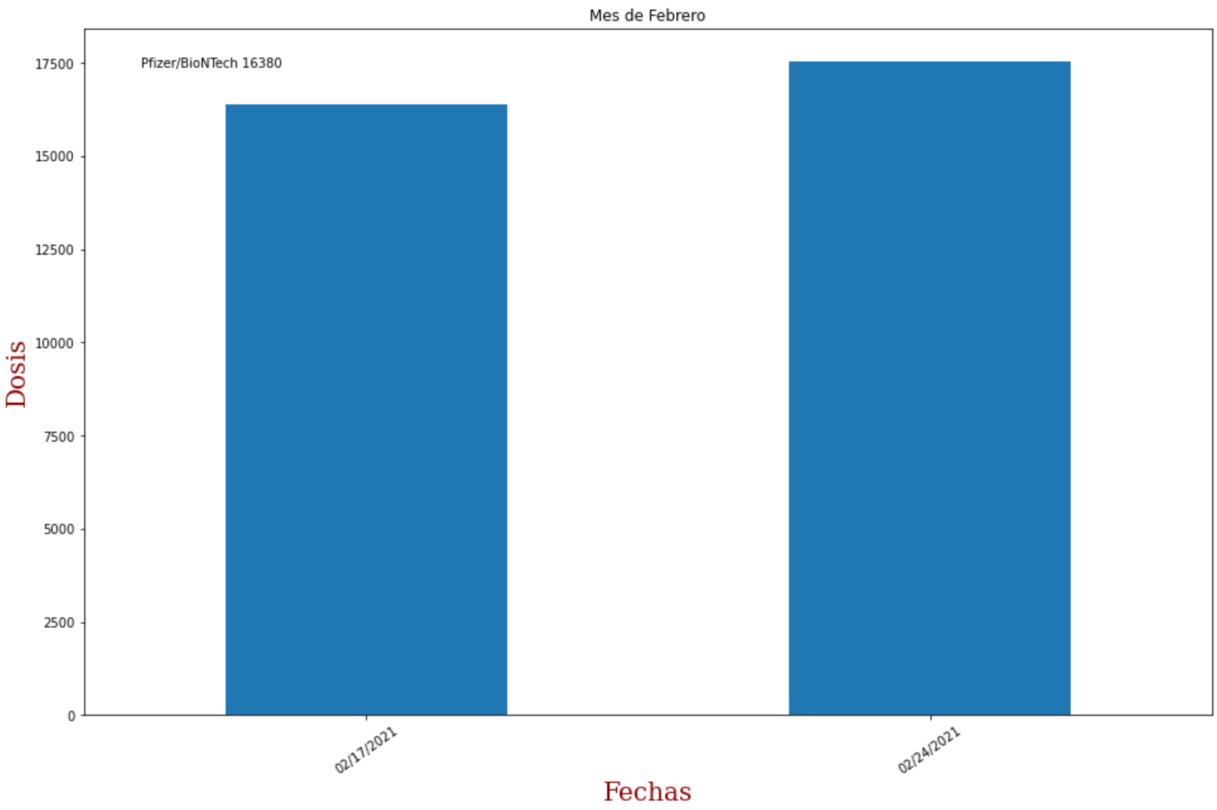
```
# Declaring the figure or the plot (y, x) or (width, height)
plt.figure(figsize = (4,6))

# Annotating the bar plot with the values (Fabricantes)
for i in range(len(listae)):
    plt.annotate(listae2[i]+' '+str(listae1[i]), (-0.25 + i, listae1[i] + j))

plt.title("Mes de Enero")
freq_series = pd.Series(listae1)
ax = freq_series.plot(kind='bar')
ax.set_xticklabels(listae, rotation = 35)
plt.xlabel('Fechas', fontsize=20, fontdict=font)
plt.ylabel('Dosis', fontsize=20, fontdict=font)
# Saving the plot as a 'png'
plt.savefig('Enero.png')
```



In [12]:
```
listaf =[]
listaf1 =[]
listaf2 =[]

febrero = fabricantes.loc[fabricantes.arrived_at.dt.month == 2]

for i in febrero['arrived_at']:
    date_time = i
    d = date_time.strftime("%m/%d/%Y")
    listaf.append(d)
print(listaf)

for i in febrero['total']:
    listaf1.append(int(i))
print(listaf1)

for i in febrero['vaccine']:
    listaf2.append((i))
print(listaf2)
```

```
['02/17/2021', '02/24/2021']
[16380, 17550]
['Pfizer/BioNTech', 'Pfizer/BioNTech']
```

In [13]:
```
# Declaring the figure or the plot (y, x) or (width, height)
plt.figure(figsize = (16,10))

# Annotating the bar plot with the values (Fabricantes)
for i in range(len(listaf)):
    plt.annotate(listaf2[i]+' '+str(listaf1[i]), (-0.4 + i, listaf1[i] + j))

plt.title("Mes de Febrero")
freq_series = pd.Series(listaf1)
ax = freq_series.plot(kind='bar')
ax.set_xticklabels(listaf, rotation = 35)
plt.xlabel('Fechas', fontsize=20, fontdict=font)
plt.ylabel('Dosis', fontsize=20, fontdict=font)
# Saving the plot as a 'png'
plt.savefig('Febrero.png')
```



In [14]:

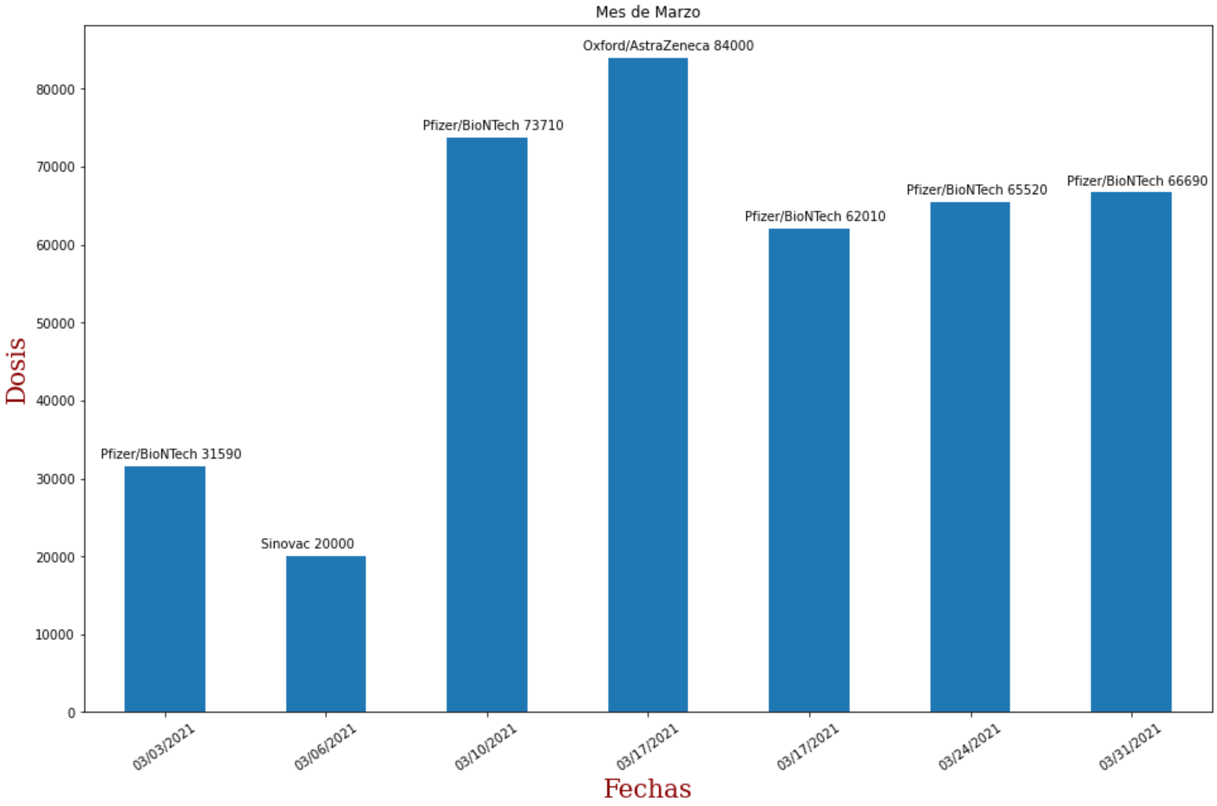
```
lista =[]
lista1 =[]
lista2 =[]

marzo = fabricantes.loc[fabricantes.arrived_at.dt.month == 3]

for i in marzo['arrived_at']:
    date_time = i
    d = date_time.strftime("%m/%d/%Y")
    lista.append(d)
print(lista)

for i in marzo['total']:
    lista1.append(int(i))
print(lista1)

for i in marzo['vaccine']:
    lista2.append((i))
print(lista2)
```

```
['03/03/2021', '03/06/2021', '03/10/2021', '03/17/2021', '03/17/2021', '03/24/2021',
'03/31/2021']
[31590, 20000, 73710, 84000, 62010, 65520, 66690]
['Pfizer/BioNTech', 'Sinovac', 'Pfizer/BioNTech', 'Oxford/AstraZeneca', 'Pfizer/BioN
Tech', 'Pfizer/BioNTech', 'Pfizer/BioNTech']
```

In [15]:

```
# Declaring the figure or the plot (y, x) or (width, height)
plt.figure(figsize = (16,10))

# Annotating the bar plot with the values (Fabricantes)
for i in range(len(lista)):
    plt.annotate(lista2[i]+' '+str(lista1[i]), (-0.4 + i, lista1[i] + j))

plt.title("Mes de Marzo")
freq_series = pd.Series(lista1)
```

```
ax = freq_series.plot(kind='bar')
ax.set_xticklabels(lista, rotation = 35)
plt.xlabel('Fechas', fontsize=20, fontdict=font)
plt.ylabel('Dosis', fontsize=20, fontdict=font)
# Saving the plot as a 'png'
plt.savefig('Marzo.png')
```



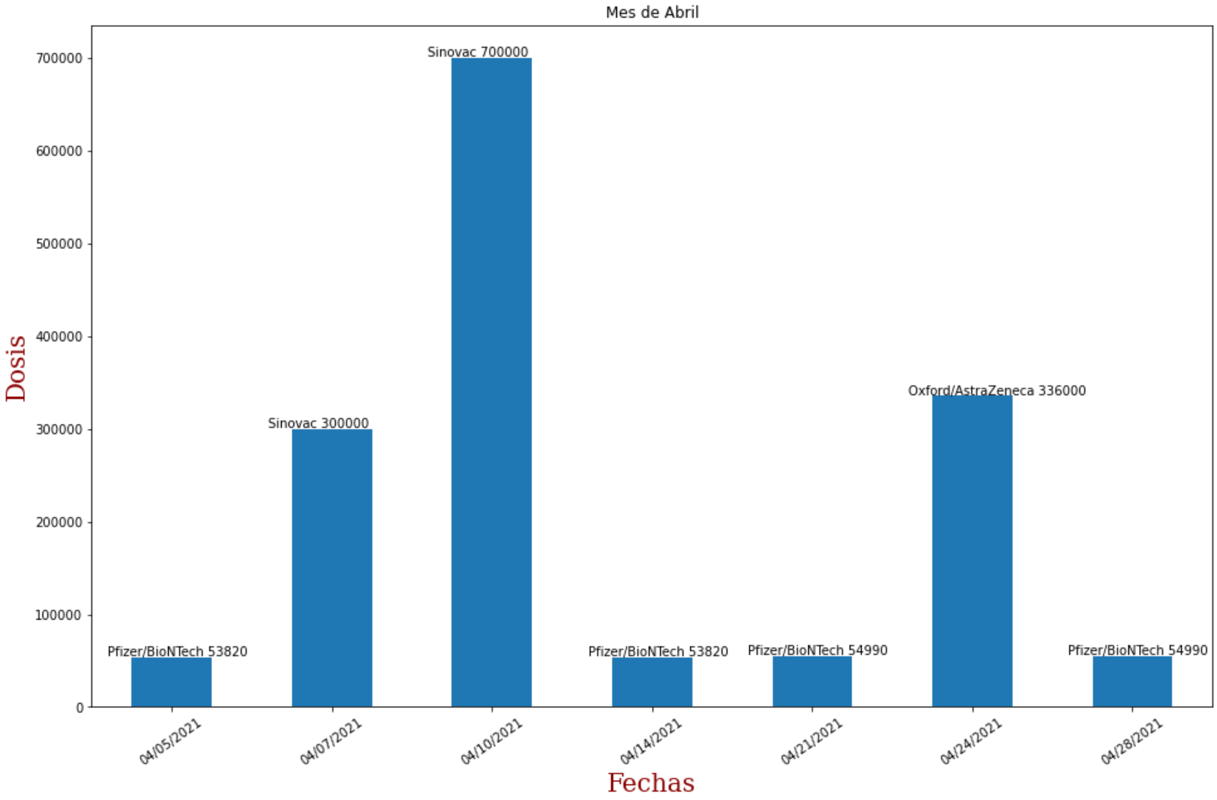
In [16]:

```
listaa =[]
listaa1 =[]
listaa2 =[]

abril = fabricantes.loc[fabricantes.arrived_at.dt.month == 4]

for i in abril['arrived_at']:
    date_time = i
    d = date_time.strftime("%m/%d/%Y")
    listaa.append(d)
print(listaa)

for i in abril['total']:
    listaa1.append(int(i))
print(listaa1)

for i in abril['vaccine']:
    listaa2.append((i))
print(listaa2)
```

```
['04/05/2021', '04/07/2021', '04/10/2021', '04/14/2021', '04/21/2021', '04/24/2021',
'04/28/2021']
[53820, 300000, 700000, 53820, 54990, 336000, 54990]
['Pfizer/BioNTech', 'Sinovac', 'Sinovac', 'Pfizer/BioNTech', 'Pfizer/BioNTech', 'Oxf
ord/AstraZeneca', 'Pfizer/BioNTech']
```

In [17]:

```
# Declaring the figure or the plot (y, x) or (width, height)
plt.figure(figsize = (16,10))

# Annotating the bar plot with the values (Fabricantes)
for i in range(len(listaa)):
    plt.annotate(listaa2[i]+' '+str(listaa1[i]), (-0.4 + i, listaa1[i] + j))
plt.title("Mes de Abril")
freq_series = pd.Series(listaa1)
ax = freq_series.plot(kind='bar')
ax.set_xticklabels(listaa, rotation = 35)
plt.xlabel('Fechas', fontsize=20, fontdict=font)
plt.ylabel('Dosis', fontsize=20, fontdict=font)
# Saving the plot as a 'png'
plt.savefig('Abril.png')
```



In [18]:

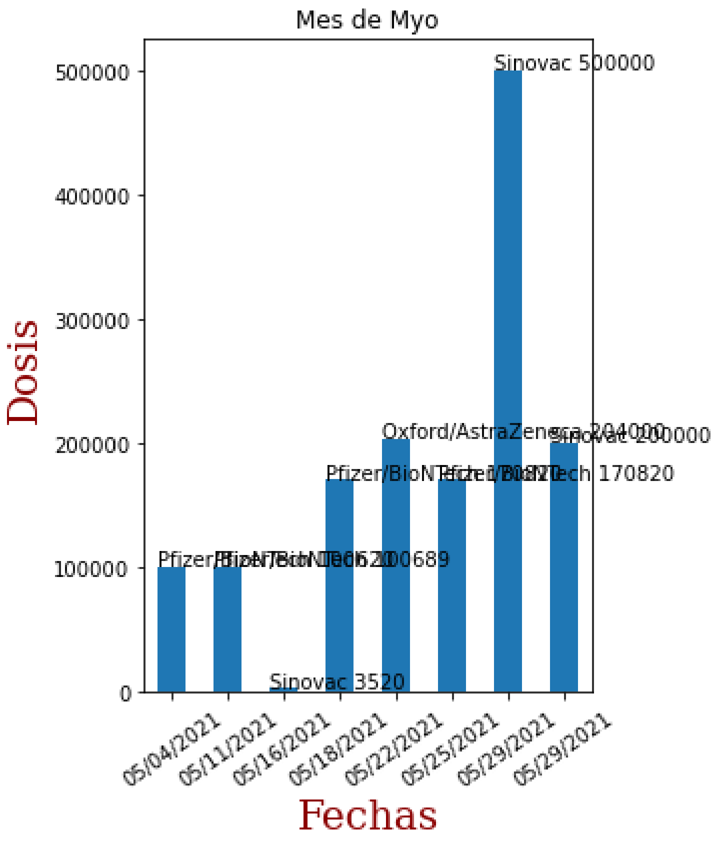
```
listam =[]
listam1 =[]
listam2 =[]

mayo = fabricantes.loc[fabricantes.arrived_at.dt.month == 5]

for i in mayo['arrived_at']:
    date_time = i
    d = date_time.strftime("%m/%d/%Y")
    listam.append(d)
print(listam)

for i in mayo['total']:
    listam1.append(int(i))
print(listam1)

for i in mayo['vaccine']:
    listam2.append((i))
print(listam2)
```

```
['05/04/2021', '05/11/2021', '05/16/2021', '05/18/2021', '05/22/2021', '05/25/2021',
'05/29/2021', '05/29/2021']
[100620, 100689, 3520, 170820, 204000, 170820, 500000, 200000]
['Pfizer/BioNTech', 'Pfizer/BioNTech', 'Sinovac', 'Pfizer/BioNTech', 'Oxford/AstraZe
neca', 'Pfizer/BioNTech', 'Sinovac', 'Sinovac']
```

In [19]:

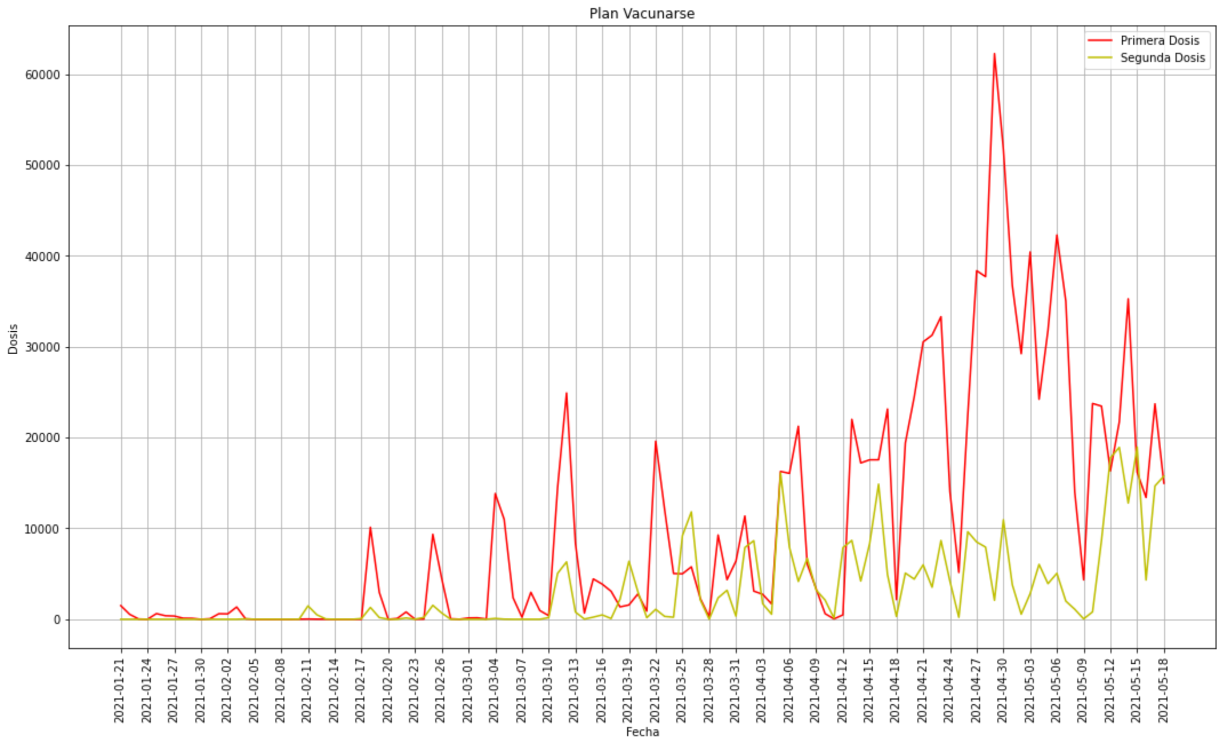
```
# Declaring the figure or the plot (y, x) or (width, height)
plt.figure(figsize = (4,6))
```

```
# Annotating the bar plot with the values (Fabricantes)
for i in range(len(listam)):
    plt.annotate(listam2[i]+' '+str(listam1[i]), (-0.25 + i, listam1[i] + j))

plt.title("Mes de Myo")
freq_series = pd.Series(listam1)
ax = freq_series.plot(kind='bar')
ax.set_xticklabels(listam, rotation = 35)
plt.xlabel('Fechas', fontsize=20, fontdict=font)
plt.ylabel('Dosis', fontsize=20, fontdict=font)
# Saving the plot as a 'png'
plt.savefig('Mayo.png')
```



Generar un reporte parametrizado que pueda ingresar los datos de las fechas inicio y fin para obtener la información de las graficas vistas en el primer punto.

In [20]:
```
plt.figure(figsize=(18,10))

plt.title('Plan Vacunarse')
plt.plot(vacunas_planvacunarse.fecha, vacunas_planvacunarse.primera_dosis, 'r-', mar
plt.plot(vacunas_planvacunarse.fecha, vacunas_planvacunarse.segunda_dosis, 'y-', mar

plt.xticks(vacunas_planvacunarse.fecha[::3].tolist())

plt.xlabel('Fecha')
plt.xticks(rotation=90)
plt.ylabel('Dosis')
plt.legend()
plt.grid(True)
plt.show()
```



Generar un modelo matemático de predicción para regresión lineal, exponencial, polinómico y logarítmico, del procesos de vacunación en base al numero actual de vacunados (1 y 2 dosis) y a la llegada de nuevas vacunas.

In [21]:

```
vacunas_planvacunarse = pd.read_csv('vacunas_planvacunarse.csv')
#imprimir los primeros 5 datos del archivo
vacunas_planvacunarse.head(5)
```

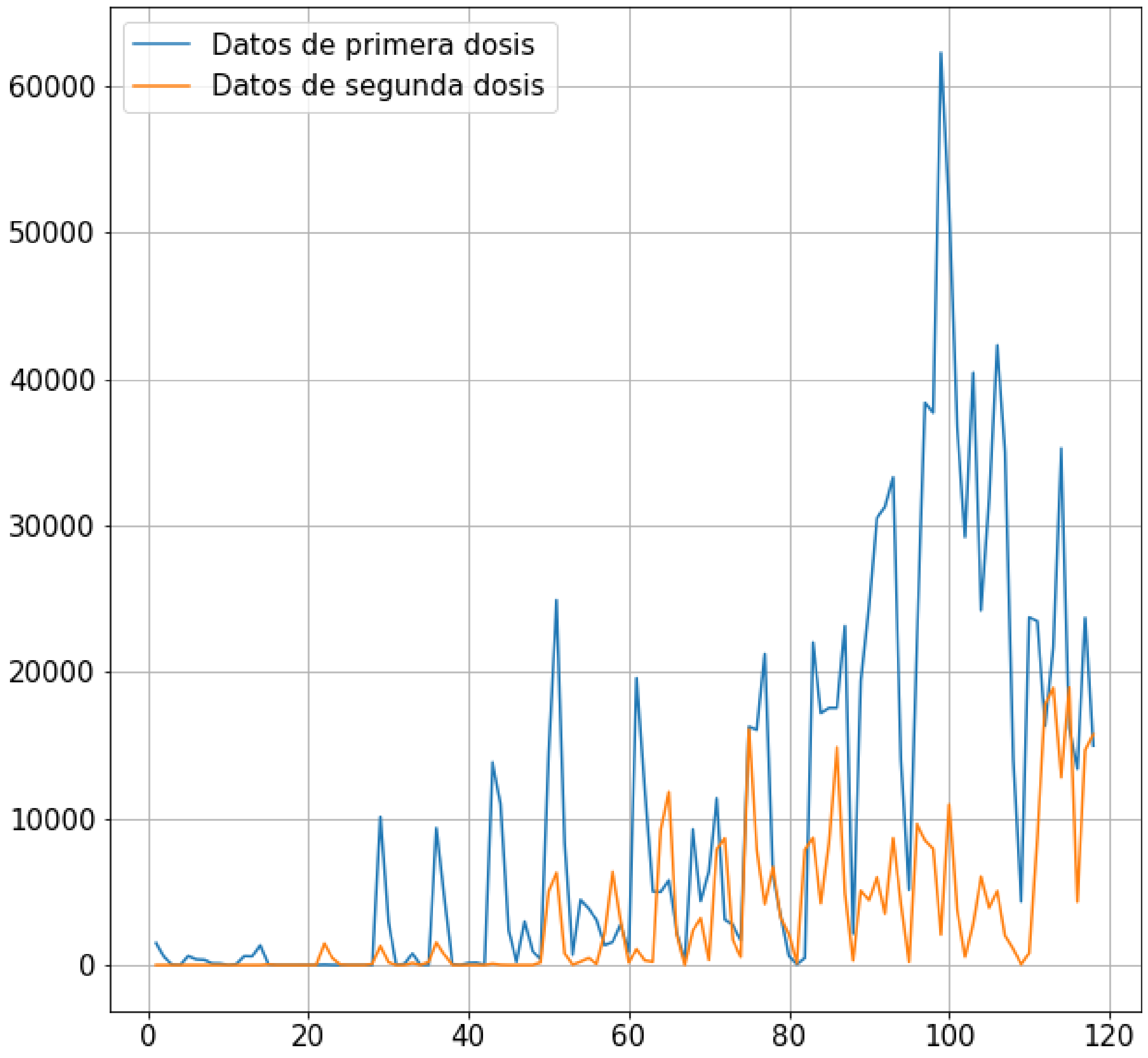
Out[21]:

	fecha	primera_dosis	segunda_dosis
0	2021-01-21	1500	0
1	2021-01-22	539	1
2	2021-01-23	31	0
3	2021-01-24	0	0
4	2021-01-25	622	0

In [22]:

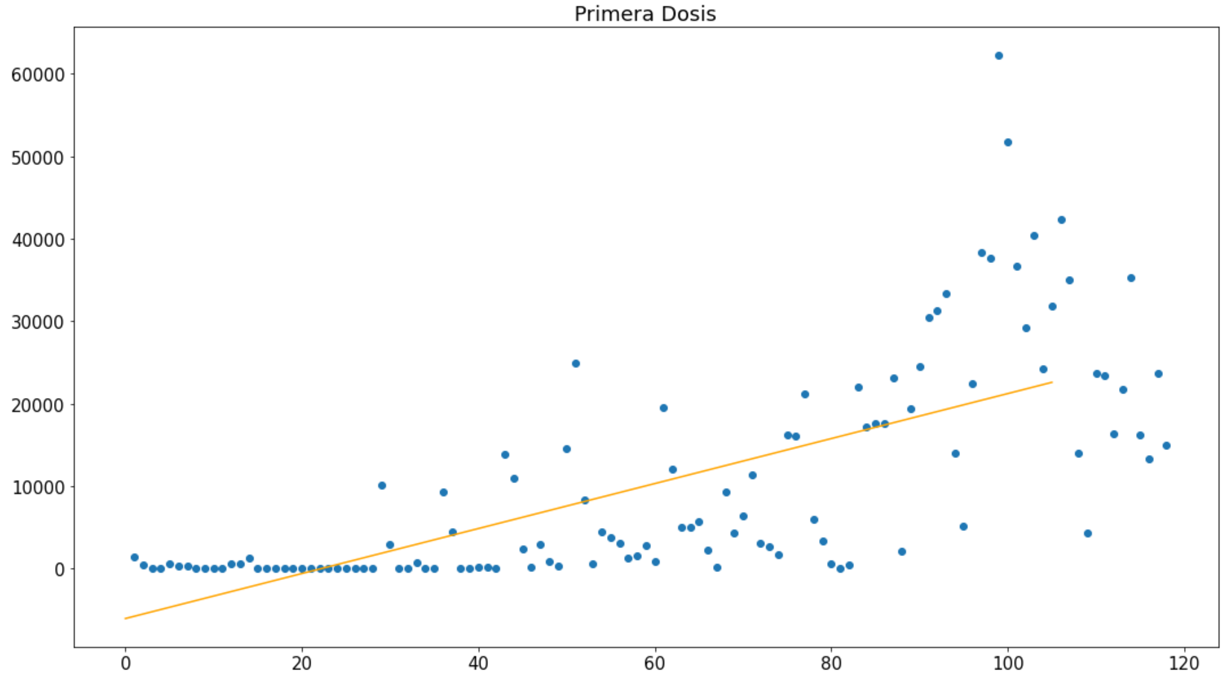
```
from sklearn.linear_model import LinearRegression
from sklearn import linear_model

#x = range(1,len(vacunas_planvacunarse)+1)
#y = vacunas_planvacunarse

#vacunas_planvacunarse['fecha'] = vacunas_planvacunarse['fecha'].str.replace('-','/'
#vacunas_planvacunarse['fecha'] = vacunas_planvacunarse['fecha'].astype(float)

start_date = "2021/01/20"

plt.rcParams['figure.figsize'] = [10,10]
plt.rc('font', size=15)
#confirmados = vacunas_planvacunarse.iloc[:105].loc[start_date:]
#vaccine2 = fabricantes.loc[fabricantes.vaccine == 'Sinovac']['total']
primera_dosis = vacunas_planvacunarse.loc[:]['primera_dosis']
segunda_dosis = vacunas_planvacunarse.loc[:]['segunda_dosis']
#print(confirmados)

x = range(1,len(primera_dosis)+1)
```

```
y = primera_dosis
z = segunda_dosis

plt.plot(x, y, label = "Datos de primera dosis")
plt.plot(x, z, label = "Datos de segunda dosis")
plt.legend()
plt.grid(True)
plt.show()
```



In [23]:

```
plt.figure(figsize=(18,10))

plt.title('Primera Dosis')

regr = linear_model.LinearRegression()
regr.fit(np.array(x).reshape(-1, 1) ,y)



y_prediccion = regr.predict([[107]])


plt.scatter(x,y)

x_real = np.array(range(0, 106))
ypred = regr.predict(x_real.reshape(-1, 1))



plt.plot(x_real, ypred, color='orange')
plt.show()

print("prediccion lineal para el 1 dia despues de la primera dosis: "+str(ypred[len(
print("prediccion lineal para los 2 dias despues de la segunda dosis: "+str(ypred[le
print(ypred)
```

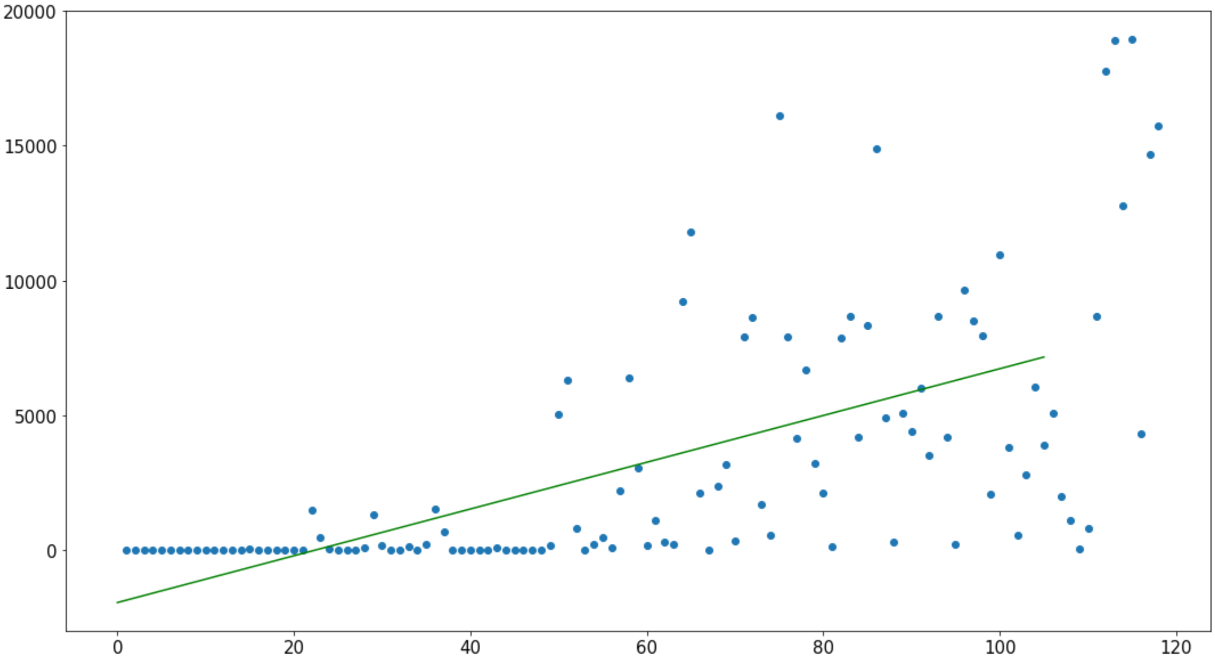


```
prediccion lineal para el 1 dia despues de la primera dosis: 22331.303017686863
prediccion lineal para los 2 dias despues de la segunda dosis: 22603.989697573947
[-6028.11169057 -5755.42501068 -5482.7383308  -5210.05165091
 -4937.36497102 -4664.67829113 -4391.99161125 -4119.30493136
 -3846.61825147 -3573.93157159 -3301.2448917  -3028.55821181
 -2755.87153192 -2483.18485204 -2210.49817215 -1937.81149226
 -1665.12481238 -1392.43813249 -1119.7514526   -847.06477271
  -574.37809283  -301.69141294   -29.00473305   243.68194683
   516.36862672   789.05530661  1061.74198649  1334.42866638
  1607.11534627  1879.80202616  2152.48870604  2425.17538593
  2697.86206582  2970.5487457   3243.23542559  3515.92210548
  3788.60878537  4061.29546525  4333.98214514  4606.66882503
  4879.35550491  5152.0421848   5424.72886469  5697.41554458
  5970.10222446  6242.78890435  6515.47558424  6788.16226412
  7060.84894401  7333.5356239   7606.22230378  7878.90898367
  8151.59566356  8424.28234345  8696.96902333  8969.65570322
  9242.34238311  9515.02906299  9787.71574288 10060.40242277
 10333.08910266 10605.77578254 10878.46246243 11151.14914232
 11423.8358222  11696.52250209 11969.20918198 12241.89586186
 12514.58254175 12787.26922164 13059.95590153 13332.64258141
 13605.3292613  13878.01594119 14150.70262107 14423.38930096
 14696.07598085 14968.76266074 15241.44934062 15514.13602051
 15786.8227004  16059.50938028 16332.19606017 16604.88274006
 16877.56941995 17150.25609983 17422.94277972 17695.62945961
 17968.31613949 18241.00281938 18513.68949927 18786.37617915
 19059.06285904 19331.74953893 19604.43621882 19877.1228987
 20149.80957859 20422.49625848 20695.18293836 20967.86961825
 21240.55629814 21513.24297803 21785.92965791 22058.6163378
 22331.30301769 22603.98969757]
```

In [24]:

```
plt.figure(figsize=(18,10))
regr.fit(np.array(x).reshape(-1, 1) ,z)

z_prediccion = regr.predict([[107]])

plt.scatter(x,z)

x_real = np.array(range(0, 106))
zpred = regr.predict(x_real.reshape(-1, 1))
```

```
plt.plot(x_real, zpred, color='green')
plt.show()

print("prediccion lineal para el 1 dia despues de la primera dosis: "+str(zpred[len(
print("prediccion lineal para los 2 dias despues de la segunda dosis: "+str(zpred[le
print(zpred)
```



```
prediccion lineal para el 1 dia despues de la primera dosis: 7075.471793410976
prediccion lineal para los 2 dias despues de la segunda dosis: 7162.199401794616
[-1944.19947849 -1857.4718701  -1770.74426172 -1684.01665334
 -1597.28904495 -1510.56143657 -1423.83382819 -1337.1062198
 -1250.37861142 -1163.65100303 -1076.92339465  -990.19578627
  -903.46817788  -816.7405695   -730.01296112  -643.28535273
  -556.55774435  -469.83013597  -383.10252758  -296.3749192
  -209.64731081  -122.91970243   -36.19209405    50.53551434
   137.26312272   223.9907311    310.71833949   397.44594787
   484.17355625   570.90116464   657.62877302   744.35638141
   831.08398979   917.81159817  1004.53920656  1091.26681494
  1177.99442332  1264.72203171  1351.44964009  1438.17724847
  1524.90485686  1611.63246524  1698.36007363  1785.08768201
  1871.81529039  1958.54289878  2045.27050716  2131.99811554
  2218.72572393  2305.45333231  2392.18094069  2478.90854908
  2565.63615746  2652.36376585  2739.09137423  2825.81898261
  2912.546591    2999.27419938  3086.00180776  3172.72941615
  3259.45702453  3346.18463291  3432.9122413   3519.63984968
  3606.36745807  3693.09506645  3779.82267483  3866.55028322
  3953.2778916   4040.00549998  4126.73310837  4213.46071675
  4300.18832513  4386.91593352  4473.6435419   4560.37115029
  4647.09875867  4733.82636705  4820.55397544  4907.28158382
  4994.0091922   5080.73680059  5167.46440897  5254.19201735
  5340.91962574  5427.64723412  5514.37484251  5601.10245089
  5687.83005927  5774.55766766  5861.28527604  5948.01288442
  6034.74049281  6121.46810119  6208.19570957  6294.92331796
  6381.65092634  6468.37853473  6555.10614311  6641.83375149
  6728.56135988  6815.28896826  6902.01657664  6988.74418503
  7075.47179341  7162.19940179]
```

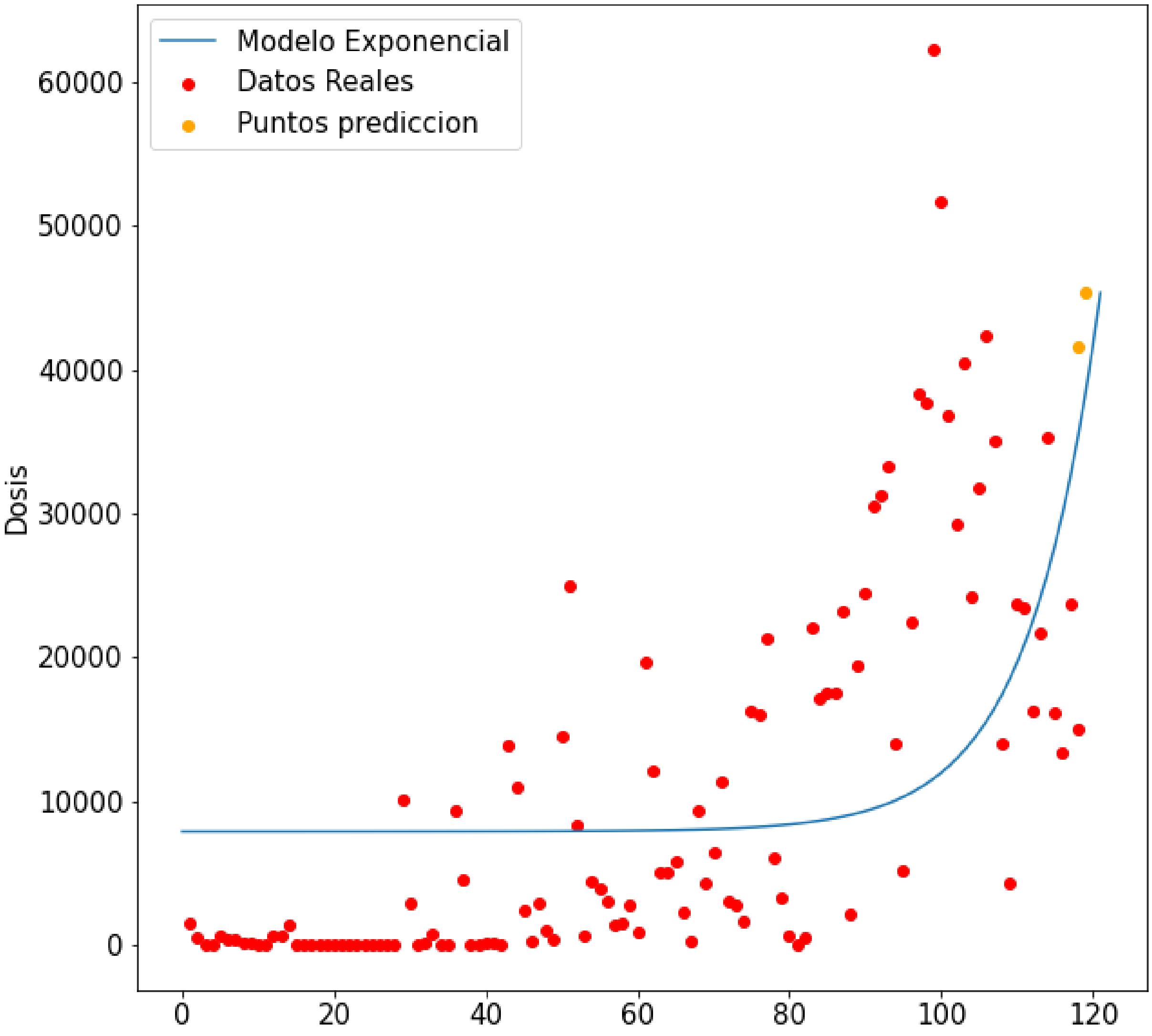
EXPONENCIAL

In [25]:

```
from scipy.optimize import curve_fit
def exponencial_model(x,a,b):
    return a+b*np.exp(x*b)

exp_fit = curve_fit(exponencial_model,x,y)
```

```
print(exp_fit)


pred_x = list(range(0,max(x)+4))
plt.rcParams['figure.figsize'] = [10,10]
plt.rc('font', size=15)

plt.scatter(x,y,label="Datos Reales",color="red")
# Predicted exponential curve
puntosreales = [exponencial_model(i,exp_fit[0][0],exp_fit[0][1]) for i in list(range

puntosprediccion = [exponencial_model(i,exp_fit[0][0],exp_fit[0][1]) for i in pred_x
predi = [round(puntosprediccion[x[len(x)-1]+2]),round(puntosprediccion[x[len(x)-1]+3


plt.plot(pred_x, puntosprediccion, label="Modelo Exponencial" )
plt.scatter(range(max(x),max(x)+2),predi,label="Puntos prediccion",color="orange")
plt.legend()
plt.ylabel("Dosis")
plt.show()

print("La prediccion para el 1 dia despues de la primera dosis: ",round(puntospredic
print("La prediccion para del 2 dia despues de la primera dosis: ",round(puntospredi
```

```
(array([7.88883528e+03, 1.05613933e-01]), array([[ 1.42554633e+06, -7.73220621e-01],
       [-7.73220621e-01,  2.82748209e-06]]))
```

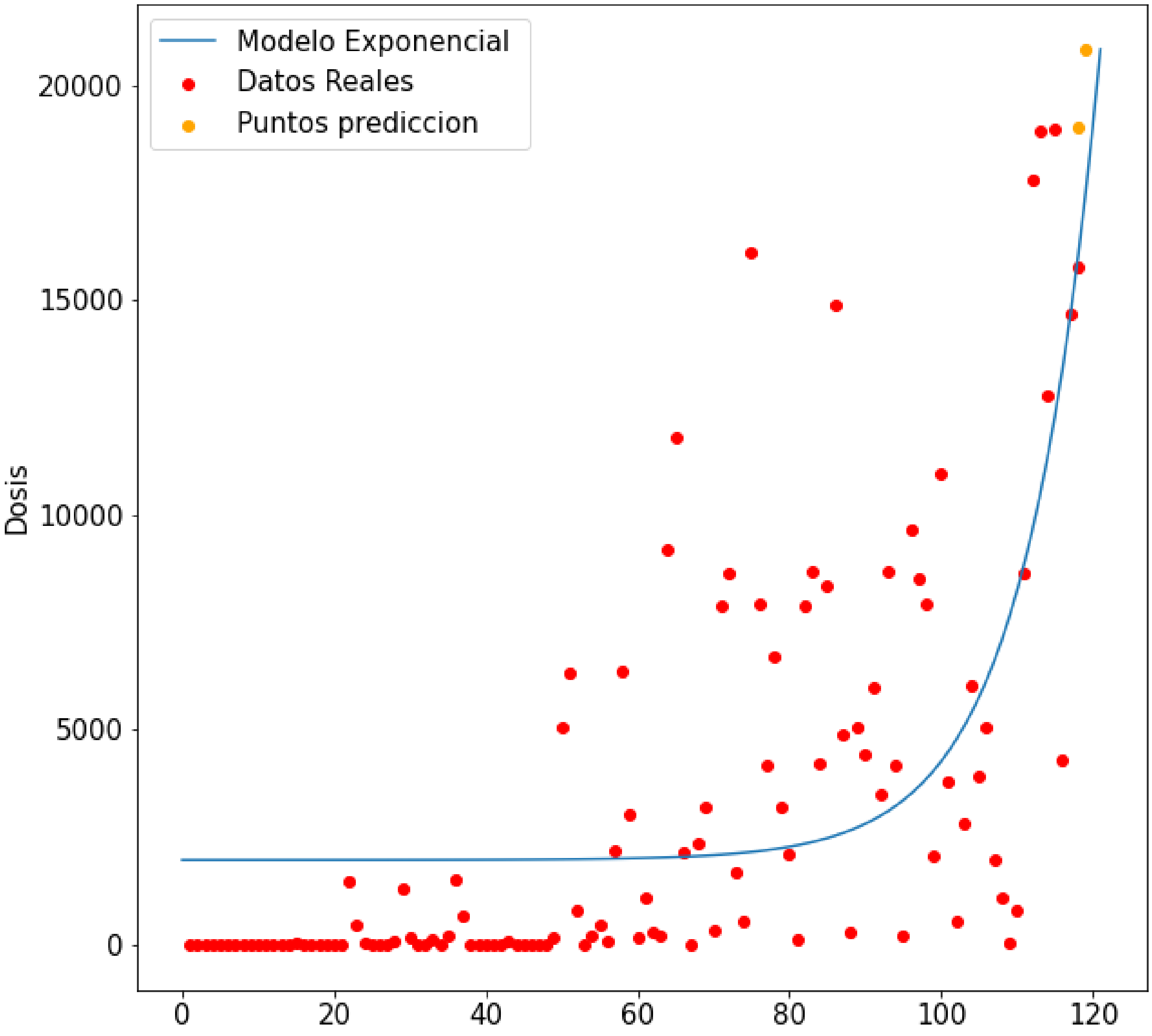


```
La prediccion para el 1 dia despues de la primera dosis:  41604
La prediccion para del 2 dia despues de la primera dosis:  45360
```

```
In [26]: exp_fit = curve_fit(exponencial_model,x,z)
         print(exp_fit)
```

```
pred_x = list(range(0,max(x)+4))
plt.rcParams['figure.figsize'] = [10,10]
plt.rc('font', size=15)

plt.scatter(x,z,label="Datos Reales",color="red")
# Predicted exponential curve
puntosreales = [exponencial_model(i,exp_fit[0][0],exp_fit[0][1]) for i in list(range

puntosprediccion = [exponencial_model(i,exp_fit[0][0],exp_fit[0][1]) for i in pred_x
predi = [round(puntosprediccion[x[len(x)-1]+2]),round(puntosprediccion[x[len(x)-1]+3


plt.plot(pred_x, puntosprediccion, label="Modelo Exponencial " )
plt.scatter(range(max(x),max(x)+2),predi,label="Puntos prediccion",color="orange")
plt.legend()

plt.ylabel("Dosis")
plt.show()

print("La prediccion para el 1 dia despues de la primera dosis: ",round(puntospredic
print("La prediccion para del 2 dia despues de la primera dosis: ",round(puntospredi
```

```
(array([1.97761577e+03, 1.00360755e-01]), array([[ 1.43686565e+05, -1.52184219e-01],
       [-1.52184219e-01,  1.03703458e-06]]))
```



```
La prediccion para el 1 dia despues de la primera dosis:  19034
La prediccion para del 2 dia despues de la primera dosis:  20835
```

Polinomial

In [27]:

```
from sklearn.preprocessing import PolynomialFeatures
pf = PolynomialFeatures(degree = 4)    #polinomio de grado 4
X = pf.fit_transform(np.array(x).reshape(-1, 1))

plt.rcParams['figure.figsize'] = [10,10]
plt.rc('font', size=15)

regresion_lineal = LinearRegression()

regresion_lineal.fit(X, y)

pred_x = list(range(0,max(x)+107))

fil = pf.fit_transform(np.array(pred_x).reshape(-1, 1))

fpredictpol = regresion_lineal.predict(fil)
onlypredicty = [fpredictpol[max(x)+1], fpredictpol[max(x)+2] ]
xpredict = range(max(x)+1,max(x)+3)
plotpol.plot(fil, fpredictpol, color='black')
plotpol.scatter(x,y,label="Reales",color="red")
plotpol.plot(xpredict,onlypredicty, 'ob',label="Prediccion")
plotpol.ylim(0,50000)
plotpol.xlim(0,115)
plotpol.legend()
plotpol.show()


print("prediccion polinomial para 1 dias despues: "+str(onlypredicty[0]))
print("prediccion polinomial para 2 dias despues: "+str( onlypredicty[1] ))
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-27-6f667d651659> in <module>
     17 onlypredicty = [fpredictpol[max(x)+1], fpredictpol[max(x)+2] ]
     18 xpredict = range(max(x)+1,max(x)+3)
---> 19 plotpol.plot(fil, fpredictpol, color='black')
     20 plotpol.scatter(x,y,label="Reales",color="red")
     21 plotpol.plot(xpredict,onlypredicty, 'ob',label="Prediccion")

NameError: name 'plotpol' is not defined
```

In [ ]:

```
pf = PolynomialFeatures(degree = 4)    #polinomio de grado 4
X = pf.fit_transform(np.array(x).reshape(-1, 1))

plt.rcParams['figure.figsize'] = [10,10]
plt.rc('font', size=15)

regresion_lineal = LinearRegression()

regresion_lineal.fit(X, z)

pred_x = list(range(0,max(x)+107))

fil = pf.fit_transform(np.array(pred_x).reshape(-1, 1))

fpredictpol = regresion_lineal.predict(fil)
onlypredicty = [fpredictpol[max(x)+1], fpredictpol[max(x)+2] ]
xpredict = range(max(x)+1,max(x)+3)
plotpol.plot(fil, fpredictpol, color='black')
plotpol.scatter(x,z,label="Reales",color="red")
plotpol.plot(xpredict,onlypredicty, 'ob',label="Prediccion")
plotpol.ylim(0,17000)
plotpol.xlim(0,170)
plotpol.legend()
plotpol.show()
```

```
print("prediccion polinomial para 1 dias despues: "+str(onlypredicty[0]))
print("prediccion polinomial para 2 dias despues: "+str( onlypredicty[1] ))
```

Logarítmico

In [ ]:

```
from scipy.optimize import curve_fit
def logistic_model(x,a,b):
    return a+b*np.log(x)

exp_fit = curve_fit(logistic_model,x,y) #Extraemos los valores de los paramatros

pred_x = list(range(min(x),max(x)+2))
plt.scatter(x,y,label="Datos Reales",color="red")
plt.rcParams['figure.figsize'] = [10,10]
plt.rc('font', size=15)
predictf = [logistic_model(i,exp_fit[0][0],exp_fit[0][1]) for i in pred_x]
onlypredict = [ predictf[len(predictf)-2], predictf[len(predictf)-1]]
plt.scatter(range(len(x),len(x)+2),onlypredict)
plt.plot(pred_x, predictf, label="Modelo logarítmico" )
plt.ylabel("Dosis")
plt.ylim(0,30000)
plt.legend()

plt.show()

print("Prediccion logarítmico para el 1 dia despues de la primera dosis:: "+str(pred
print("Prediccion logarítmico para los 2 dias despues de la segunda dosis: "+str( pr
```

In [ ]:

```
exp_fit = curve_fit(logistic_model,x,z) #Extraemos los valores de los paramatros

pred_x = list(range(min(x),max(x)+2))
plt.scatter(x,z,label="Datos Reales",color="red")
plt.rcParams['figure.figsize'] = [10,10]
plt.rc('font', size=15)
predictf = [logistic_model(i,exp_fit[0][0],exp_fit[0][1]) for i in pred_x]
onlypredict = [ predictf[len(predictf)-2], predictf[len(predictf)-1]]
plt.scatter(range(len(x),len(x)+2),onlypredict)
plt.plot(pred_x, predictf, label="Modelo logarítmico" )
plt.ylabel("Dosis")
plt.ylim(0,18000)
plt.legend()

plt.show()

print("Prediccion logarítmico para el 1 dia despues de la primera dosis:: "+str(pred
print("Prediccion logarítmico para los 2 dias despues de la segunda dosis: "+str( pr
```

In [ ]: