Question 1

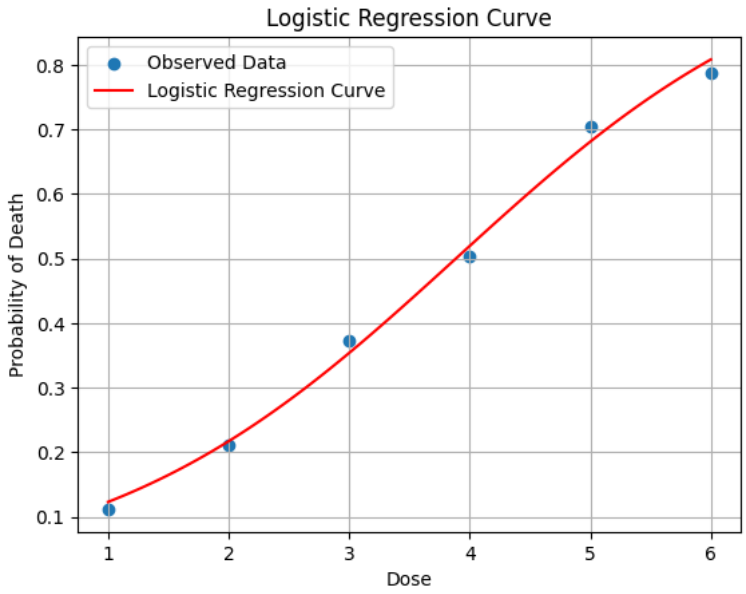
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from scipy.optimize import curve_fit


Dose = np.array([1, 2, 3, 4, 5, 6])
Deaths = np.array([28, 53, 93, 126, 176, 197])
SampleSize = np.array([250, 250, 250, 250, 250, 250])


def logistic_function(dose, beta0, beta1):
    return 1 / (1 + np.exp(-(beta0 + beta1 * dose)))

params, covariance = curve_fit(logistic_function, Dose, Deaths / SampleSize)
estimated_beta0, estimated_beta1 = params


plt.scatter(Dose, Deaths / SampleSize, label='Observed Data')
dose_range = np.linspace(min(Dose), max(Dose), 100)
logistic_curve = logistic_function(dose_range, estimated_beta0, estimated_beta1)
plt.plot(dose_range, logistic_curve, color='red', label='Logistic Regression Curve')
plt.xlabel('Dose')
plt.ylabel('Probability of Death')
plt.title('Logistic Regression Curve')
plt.legend()
plt.grid(True)
plt.show()
```




```
print("Logistic Equation: P(Death) = 1 / (1 + e^(-({:.4f} + {:.4f} * Dose)))".format(estimated_beta0, estimated_beta1))
```

```
Logistic Equation: P(Death) = 1 / (1 + e^(-(-2.6423 + 0.6801 * Dose)))
```

Question 3

```
df3 = pd.read_csv("User_Data.csv")


df3.head()
```

```
df3.shape
```

```
(400, 5)
```

```
df3.describe()
```

	User ID	Age	EstimatedSalary	Purchased
count	4.000000e+02	400.000000	400.000000	400.000000
mean	1.569154e+07	37.655000	69742.500000	0.357500
std	7.165832e+04	10.482877	34096.960282	0.479864
min	1.556669e+07	18.000000	15000.000000	0.000000
25%	1.562676e+07	29.750000	43000.000000	0.000000
50%	1.569434e+07	37.000000	70000.000000	0.000000
75%	1.575036e+07	46.000000	88000.000000	1.000000
max	1.581524e+07	60.000000	150000.000000	1.000000

```
df3.dtypes
```

```
User ID             int64
Gender             object
Age                 int64
EstimatedSalary     int64
Purchased           int64
dtype: object
```

```
x = df3.iloc[:, [2, 3]].values
y = df3.iloc[:, 4].values
```

```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(x, y, test_size=0.25, random_state=42)
```

```
from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

```
from sklearn.linear_model import LogisticRegression

lr = LogisticRegression()
lr.fit(X_train, y_train)
```

```
▾ LogisticRegression
LogisticRegression()
```

```
y_pred = lr.predict(X_test)
```

```
from sklearn.metrics import confusion_matrix

cm = confusion_matrix(y_test, y_pred)
print ("Confusion Matrix : \n", cm)
```

```
Confusion Matrix :
 [[61  2]
 [12 25]]
```

```
test_accuracy = lr.score(X_test, y_test)
print("Test Accuracy", test_accuracy)
```

```
Test Accuracy 0.86
```