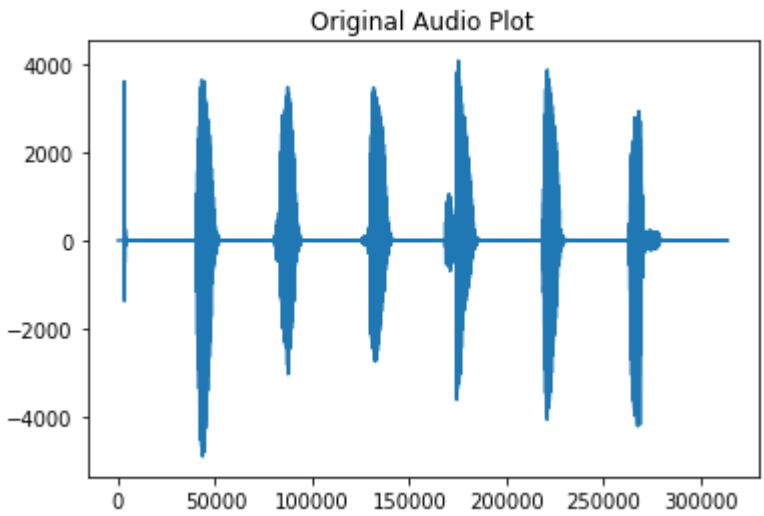
Getting Dependencies

In [ ]:
```
from scipy.io import wavfile
import numpy as np
import matplotlib.pyplot as plt
import math
import sounddevice as sd
import random
import string
from Crypto.Cipher import AES
```

Input for AES.

In [ ]:
```
fs, data = wavfile.read('audio.wav')
plt.plot(data)            # fs = sampling frequency = 44.1kHz
plt.title("Original Audio Plot")
```

Out[ ]:
```
Text(0.5, 1.0, 'Original Audio Plot')
```



In [ ]:
```
with open('audio.wav', 'rb') as fd:
    contents = fd.read()
```

Getting ready with AES

In [ ]:
```
AES_KEY = ''.join(random.choice(string.ascii_uppercase + string.ascii_lowercase + strin

AES_IV = ''.join(random.choice(string.ascii_uppercase + string.ascii_lowercase + string
```

In [ ]:
```
print("AES Key is ", AES_KEY)
print("AES Initialization vector is ", AES_IV)
```

```
AES Key is  aDmxEVMgZM1OSkXTJ4X0XGjn7UFkN5gu
AES Initialization vector is  3AlBZgC3LkdWvJli
```

Encryption using AES

In [ ]:
```
encryptor = AES.new(AES_KEY.encode("utf-8"), AES.MODE_CFB, AES_IV.encode("utf-8"))
encrypted_audio = encryptor.encrypt(contents)
```

In [ ]:
```
with open('encrypted_audio_file.wav', 'wb') as fd:
    fd.write(encrypted_audio)
print("A file titled 'encrypted_audio_file.wav' is generated which is the encrypted aud
```

```
A file titled 'encrypted_audio_file.wav' is generated which is the encrypted audio to be
communicated
```

In [ ]:
```
with open('encrypted_audio_file.wav', 'rb') as fd:
    contents = fd.read()
```

In [ ]:
```
fs, data = wavfile.read('audio.wav')
k = np.asarray(data, dtype = np.int32)
#print(k)
```

Generate Public and Private Key

In [ ]:
```
p1 = int(input("Enter first prime number: "))
p2 = int(input("Enter second prime number: "))
p3 = int(input("Enter third prime number: "))
p4 = int(input("Enter forth prime number: "))

n = p1*p2*p3*p4
print("n = p1*p2 = ",n)

e = int(input("Enter a small, odd number, co-prime with n: "))
k = int(input("Enter value of k:"))

phi = (p1-1)*(p2-1)*(p3-1)*(p4-1)
print("phi = ",phi)

d = int((k*phi+1)/e)

print("d= ",d)

public_key = n,e
private_key = n,d

print("Public Key = ", public_key)
print("Private Key = ",private_key)
```

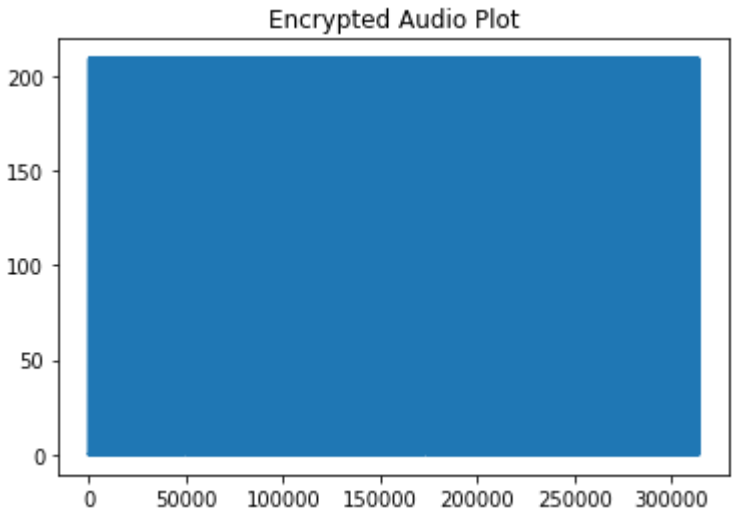
```
n = p1*p2 =  210
phi =  48
d=  80
```

```
Public Key =  (210, 3)
Private Key =  (210, 80)
```

Encrypt message using public key

In [ ]:
```
encrypted=[]
for i in data:
    encrypted.append((i**e)%n)
#encrypted = (data**e)%n
#print(encrypted)
plt.plot(encrypted)
plt.title("Encrypted Audio Plot")
```

Out[ ]:
```
Text(0.5, 1.0, 'Encrypted Audio Plot')
```



Write the Encrpyted File into an audio file

In [ ]:
```
with open('encrypted_audio_file.wav', 'wb') as fd:
    fd.write(encrypted_audio)
print("A file titled 'encrypted_audio_file.wav' is generated which is the encrypted aud
```

```
A file titled 'encrypted_audio_file.wav' is generated which is the encrypted audio to be
communicated
```

Decryption

In [ ]:
```
#RSA Decryption:XXX
```

In [ ]:
```
'''fs, Data = wavfile.read('encrypted_audio_file.wav')
plt.plot(Data)
print(Data)
ke = np.asarray(Data, dtype = np.int32)'''
```

Out[ ]:
```
"fs, Data = wavfile.read('encrypted_audio_file.wav')\nplt.plot(Data)\nprint(Data)\nke =
np.asarray(Data, dtype = np.int32)"
```

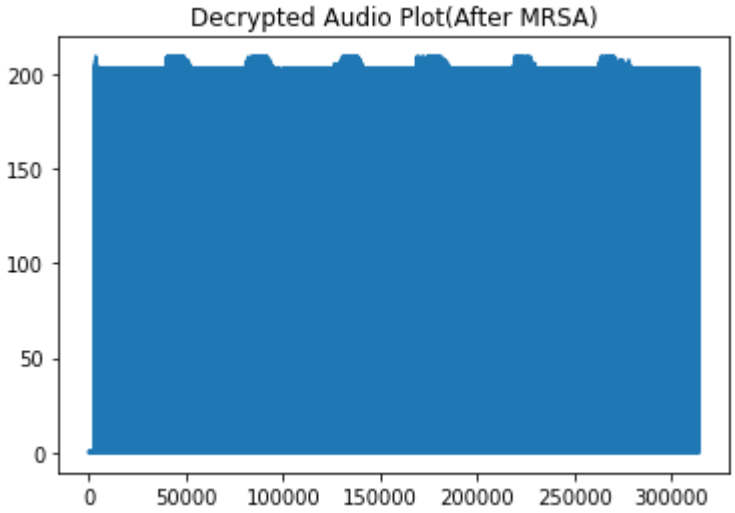
In [ ]:

```
# Python program to compute
# factorial of big numbers

# Maximum number of digits in
# output
MAX=100000

# This function multiplies x
# with the number represented by res[].
# res_size is size of res[] or
# number of digits in the number
# represented by res[]. This function
# uses simple school mathematics
# for multiplication.
# This function may value of res_size
# and returns the new value of res_size
def multiply(x, res, res_size):

        # Initialize carry
        carry = 0

        # One by one multiply n with
        # individual digits of res[]
        for i in range(res_size):
                prod = res[i] * x + carry

                # Store last digit of
                # 'prod' in res[]
                res[i] = prod % 10

                # Put rest in carry
                carry = prod // 10

        # Put carry in res and
        # increase result size
        while (carry):
                res[res_size] = carry % 10
                carry = carry // 10
                res_size+=1

        return res_size


# This function finds
# power of a number x
def power(x,n):

        # printing value "1" for power = 0
        if (n == 0) :
                print("1")
                return

        res=[0 for i in range(MAX)]
        res_size = 0
        temp = x

        # Initialize result
        while (temp != 0):
```

```
                res[res_size] = temp % 10;
                res_size+=1
                temp = temp // 10


        # Multiply x n times
        # (x^n = x*x*x....n times)
        for i in range(2, n + 1):
                res_size = multiply(x, res, res_size)

        print(x , "^" , n , " = ",end="")
        for i in range(res_size - 1, -1, -1):
                print(res[i], end="")

#exponent = 100
#base = 2
#power(base, exponent)

decrypted = (data**d)%n
plt.plot(decrypted)
print(decrypted)
plt.title('Decrypted Audio Plot(After MRSA)')
```

Out[ ]:

```
[  0   0   1 ... 141 141   0]
Text(0.5, 1.0, 'Decrypted Audio Plot(After MRSA)')
```



Write the Decrpyted File into an audio file

In [ ]:

```
encrypted = np.asarray(encrypted,dtype=np.int16)
wavfile.write('decrypted.wav',fs,encrypted)
print("A file titled 'decrypted.wav' is generated which is analog of the audio")
```

```
A file titled 'decrypted.wav' is generated which is analog of the audio
```

Loading

In [ ]:

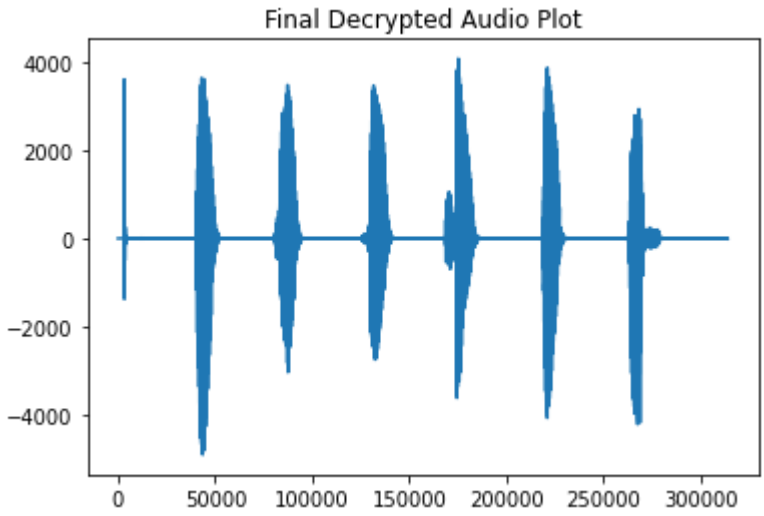
```
with open('encrypted_audio_file.wav', 'rb') as fd:
    contents = fd.read()
```

Decryption of data

In [ ]:
```
decryptor = AES.new(AES_KEY.encode("utf-8"), AES.MODE_CFB, AES_IV.encode("utf-8"))
decrypted_audio = decryptor.decrypt(contents)
```

In [ ]:
```
with open('decrypted_audio_file.wav', 'wb') as fd:
    fd.write(decrypted_audio)
```

In [ ]:
```
fs, data = wavfile.read('decrypted_audio_file.wav')
plt.plot(data)            # fs = sampling frequency = 44.1kHz
plt.title("Final Decrypted Audio Plot")
data_1 = np.asarray(data, dtype = np.int32)
```



In [ ]:
```
sd.play(data, fs)
```