19CCE303 – DIGITAL COMMUNICATION

ASSIGNMENT II

PROBLEM:

Fundamentals of Communication Systems, John G. Proakis, Masoud Salehi, Pearson Education, Second Edition, 2015

Chapter 10 – Digital Transmission through Bandlimited Channels

Computer Problem 10.5 Precoding for Duobinary Signals

Write a Python program that takes a binary data sequence $\{d_k\}$, pre-codes it for a duobinary pulse transmission system to produce the sequence $\{p_k\}$, and maps the pre-coded sequence into the transmitted amplitude levels $\{a_k\}$. Then, from the transmitted sequence $\{a_k\}$, and from the received noise-free sequences $\{b_k\}$, recover the original data sequence $\{d_k\}$. Verify the operation of your program using the data sequence {1 0 0 1 0 1 1 1 0 1 1 0}.

SOFTWARE REQUIRED:

- Windows 10 Operating System
- Anaconda3 2021.11 (Python 3.9.7 64-bit)
- The Scientific Python Development Environment (Spyder) 5.1.5

PYTHON CODE:

```
binary_data = [1,0,0,1,0,1,1,1,0,1,1,0]
print("\nBinary Data Sequence, {dk}: ", binary_data)

# Precodes it for a duobinary pulse transmission system to produce the
sequence, {pk}: -
pn =[]; pn.append(0); m = 2
for i in range(len(binary_data)):
    pn.append((binary_data[i]-pn[i])%m)
print("Precoded and Produced Sequence, {pk}: ", pn)

# Maps the precoded sequence into the transmitted amplitude levels, {ak}: -
an = []
for i in range(0,len(pn)):
    an.append( 2*pn[i] -(m-1))
print("Transmitted Amplitude Levels, {ak}: ", an)

# Received noise-free sequences, {bk}: -
bn = []
for i in range(1,len(pn)):
    bn.append(an[i]+an[i-1])
```

```
print("Received Noise-Free Sequences, {bk}: ", bn)

# Recover the original data sequence: -
dn = []
for i in range(len(bn)):
    dn.append(int((((bn[i]/2)+(m-1))%m)))
print("Recovered Original Data Sequence: ", dn)
```

```
Python 3.9.7 (default, Sep 16 2021, 16:59:28) [MSC v.1916 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.

IPython 7.29.0 -- An enhanced Interactive Python.

Restarting kernel...
```

```
In [1]:         'E:/Plan B/Amrita Vishwa Vidyapeetham/Subject Materials/Semester V/
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19CCE303_Assignment_II_Code.py'      ='E:/Plan B/Amrita Vishwa Vidyapeetham/Subject
Materials/Semester V/19CCE303 - Digital Communication/Assignments/Assignment II'

Binary Data Sequence, {dk}:  [1, 0, 0, 1, 0, 1, 1, 1, 0, 1, 1, 0]
Precoded and Produced Sequence, {pk}:  [0, 1, 1, 1, 0, 0, 1, 0, 1, 1, 0, 1, 1]
Transmitted Amplitude Levels, {ak}:  [-1, 1, 1, 1, -1, -1, 1, -1, 1, 1, -1, 1, 1]
Received Noise-Free Sequences, {bk}:  [0, 2, 2, 0, -2, 0, 0, 0, 2, 0, 0, 2]
Recovered Original Data Sequence:  [1, 0, 0, 1, 0, 1, 1, 1, 0, 1, 1, 0]

In [2]:
```