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CSC-453 Signals Processing Laboratory Assignment

Lab Assignment - 3:

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# Q 3. Basic Operations on signal

import matplotlib.pyplot as plt

import numpy as np


t = np.arange(-5, 20, 0.2)

plt_1 = plt.figure(figsize=(40/2, 30/2))


def x(a):

    #x(t)

    if (a >= 0 and a < 5):

        tx = 1

    elif(a >= 5 and a < 8):

        tx = 2

    elif(a >= 8 and a < 12):

        tx = 5

    else:

        tx = 0

    return tx


def y(a):

    if (a >= 0 and a < 7):

        ty = 2
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    elif(a >= 7 and a < 10):
        ty = 0
    elif(a >= 10 and a < 15):
        ty = 7
    else:
        ty = 0
    return ty


#X(t)
z = []
for i in t:
    z.append(x(i))
plt.subplot(3, 4, 1)
plt.plot(t, z)
plt.xlim([min(t), max(t)])
plt.xlabel('Time (s)-->')
plt.ylabel('waveform-->')
plt.title('x(t)')


#Y(t)
z = []
for i in t:
    z.append(y(i))
plt.subplot(3,4,2)
plt.plot(t,z)
plt.xlim([min(t), max(t)])
plt.xlabel('Time (s)-->')
plt.ylabel('waveform-->')
plt.title('y(t)')
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#X(t)+Y(t)
z = []
for i in t:
    z.append(x(i)+y(i))
plt.subplot(3,4,3)
plt.plot(t,z)
plt.xlim([min(t), max(t)])
plt.xlabel('Time (s)-->')
plt.ylabel('waveform-->')
plt.title('x(t)+y(t)')

#X(t)-Y(t)
z = []
for i in t:
    z.append(x(i)-y(i))
plt.subplot(3,4,4)
plt.plot(t,z)
plt.xlim([min(t), max(t)])
plt.xlabel('Time (s)-->')
plt.ylabel('waveform-->')
plt.title('x(t)-y(t)')

# X*Y Plot
z = []
for i in t:
    z.append(x(i)*y(i))
plt.subplot(3,4,5)
plt.plot(t,z)
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plt.xlim([min(t), max(t)])
plt.xlabel('Time (s)-->')
plt.ylabel('waveform-->')
plt.title('x(t)*y(t)')

# X/2+Y/3 Plot
z = []
for i in t:
    z.append(x(i)/3 + y(i)/3)
plt.subplot(3,4,6)
plt.plot(t,z)
plt.xlim([min(t), max(t)])
plt.xlabel('Time (s)-->')
plt.ylabel('waveform-->')
plt.title('x(t)/2+y(t)/3')

# X(-t) plot
z = []
for i in t:
    z.append(x(-i))
plt.subplot(3,4,7)
plt.plot(t,z)
plt.xlim([min(t), max(t)])
plt.xlabel('Time (s)-->')
plt.ylabel('waveform-->')
plt.title('x(-t)')

# Y(-t) plot
z = []
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for i in t:
    z.append(y(-i))
plt.subplot(3,4,8)
plt.plot(t,z)
plt.xlim([min(t), max(t)])
plt.xlabel('Time (s)-->')
plt.ylabel('Waveform-->')
plt.title('y(-t)')

# X(2t) plot
z = []
for i in t:
    z.append(x(2*i))
plt.subplot(3,4,9)
plt.plot(t,z)
plt.xlim([min(t), max(t)])
plt.xlabel('Time (s)-->')
plt.ylabel('Waveform-->')
plt.title('x(2t)')

# X(-2t+5) plot
z = []
for i in t:
    z.append(x(-2*i + 5))
plt.subplot(3,4,10)
plt.plot(t,z)
plt.xlim([min(t), max(t)])
plt.xlabel('Time (s)-->')
plt.ylabel('Waveform-->')
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plt.title('x(-2t+5)')


# X(0.5t-5) plot
z = []
for i in t:
    z.append(x(0.5*i - 5))
plt.subplot(3,4,11)
plt.plot(t,z)
plt.xlim([min(t), max(t)])
plt.xlabel('Time (s)-->')
plt.ylabel('Waveform-->')
plt.title('x(0.5t-5)')


# X(-0.5t-5) plot
z = []
for i in t:
    z.append(x(-0.5*i - 5))
plt.subplot(3,4,12)
plt.plot(t,z)
plt.xlim([min(t), max(t)])
plt.xlabel('Time (s)-->')
plt.ylabel('Waveform-->')
plt.title('x(-0.5t-5)')


plt.subplots_adjust(left = 1,  # the left side of the subplots of the figure
right = 2,    # the right side of the subplots of the figure
bottom = 1,   # the bottom of the subplots of the figure
top = 2,      # the top of the subplots of the figure
wspace = 0.9,   # the amount of width reserved for blank space between subplots
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hspace = 0.9)   # the amount of height reserved for white space between subplots)

plt.show()
```