Digital Signal Processing Lab

Demo 3 - Exercise 6 (Pyaudio, stereo)

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Solution

To solve this, we just duplicate the values and open two channels.

- Duplicate per-sample values when packing (interleave L,R) with two different values for the denominator:

```
a1_L = -0.5
a2_L = 0.8

a1_R = -1.9
a2_R = 0.998

y1_L = 0.0
y2_L = 0.0
y1_R = 0.0
y2_R = 0.0
```

- Since we want two independent channels, compute two y's and pack them using the ¡hh directive for stereo:

```
# left/right states and coeffs exist: (y1_L,y2_L,a1_L,a2_L), (y1_R,y2_R,a1_R
    ,a2_R)
yL = x0 - a1_L*y1_L - a2_L*y2_L
yR = x0 - a1_R*y1_R - a2_R*y2_R
y2_L, y1_L = y1_L, yL
y2_R, y1_R = y1_R, yR
output_string = struct.pack('<hh', int(gain*yL), int(gain*yR))
```

- Open the stream with two channels:

```
stream = p.open(format=pyaudio.paInt16,
                channels=2,       # <-- was 1
                rate=Fs,
                input=False,
                output=True)
```

Here is the final solution:

```
import pyaudio
import struct

Fs = 8000
T = 2
N = T * Fs

a1_L = -0.5
a2_L = 0.8

a1_R = -1.9
a2_R = 0.998

y1_L = 0.0
y2_L = 0.0
y1_R = 0.0
y2_R = 0.0

gain = 5000.0
```

```
20
21 p = pyaudio.PyAudio()
22 stream = p.open(format=pyaudio.paInt16,
23                 channels=2,
24                 rate=Fs,
25                 input=False,
26                 output=True)
27
28 for n in range(0, N):
29     if n == 0:
30         x0 = 1.0
31     else:
32         x0 = 0.0
33
34     y0_L = x0 - a1_L * y1_L - a2_L * y2_L
35     y0_R = x0 - a1_R * y1_R - a2_R * y2_R
36
37     y2_L, y1_L = y1_L, y0_L
38     y2_R, y1_R = y1_R, y0_R
39
40     output_value_L = gain * y0_L
41     output_value_R = gain * y0_R
42     output_string = struct.pack('<hh', int(output_value_L), int(output_value_R))
43     stream.write(output_string)
44
45 print("* Finished *")
46
47 stream.stop_stream()
48 stream.close()
49 p.terminate()
```