

CSCI366 Multimedia Computing

Assignment Three (15%)

Due Date: (Please check with Dr. Loo)

Tasks

You are required to develop the following DPCM encoder and decoder without the entropy coding component or symbol coder.

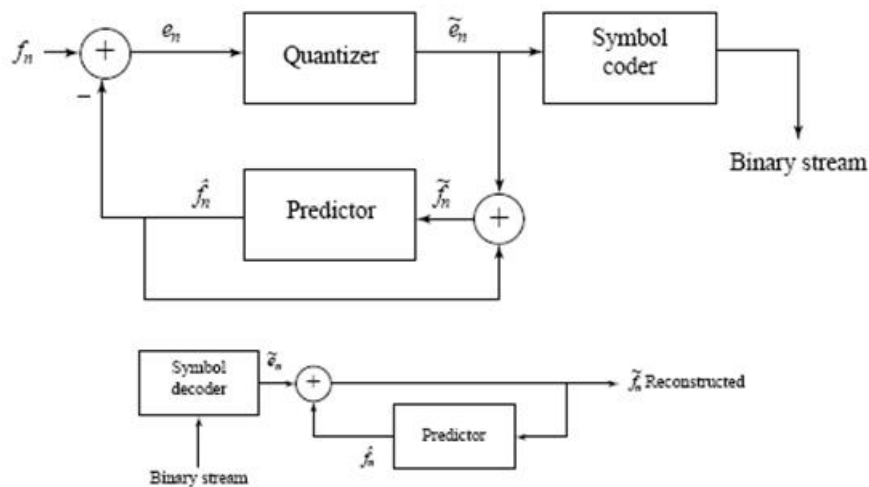


Figure 1. Schematic diagram for DPCM encoder and decoder

$$\hat{f} = \text{truncation} \left(\frac{\tilde{f}_{n-1} + \tilde{f}_{n-2}}{2} \right)$$

$$e_n = f_n - \hat{f}_n$$

$$\tilde{e}_n = Q[e_n] = 16 * \text{truncation} \left(\frac{255 + e_n}{16} \right) - 256 + 8$$

$$\tilde{f}_n = \tilde{e}_n + \hat{f}_n$$

In the encoding mode, the program shall take an arbitrary number of unsigned 8-bit samples and outputs the corresponding sequence of the quantized differences \tilde{e}_n . In the decoding mode, the program takes an arbitrary number of quantized differences \tilde{e}_n and outputs the corresponding sequence of reconstructed samples \tilde{f}_n .

Requirements

1. The program should be named as “**dpcm**” and shall take one of the following command line options to define its working mode and a sequence of samples f_n whose values range from 0 to 255 or quantized differences \tilde{e}_n that would be possibly output from the encoder.
 - a. “**-e**” for encoding
 - b. “**-d**” for decoding
 - c. “**-h**” for help with the usage of the program

2. The program outputs either the sequence of \tilde{e}_n including the first sample, if the program works in the encoding mode, or the sequence of \tilde{f}_n , if the program works in the decoding mode.

Here are three examples of using the program:

```
$ dpcm -h
```

```
dpcm -[h|e|d] n1 n2 n3 ...
      -e encoding mode
      -d decoding mode
      -h this help
```

```
$dpcm -e 130 150 140 200 230
Encoding output: 130 24 -8 56 56
```

```
$dpcm -d 130 24 -8 56
Decoding output: 130 154 134 200
```

3. In encoding, the program not only outputs the sequence of \tilde{e}_n as shown in (2), but also output the distortion in Signal to Noise Ratio (SNR) between the original sequence of samples f_n and the reconstructed sequence of samples \tilde{f}_n .

```
$dpcm -e 130 150 140 200 230 ...
Encoding output: 130 24 -8 56 56 ...
SNR:  xx.xx (dB)
```

4. You MUST supply a *Makefile* together with your source code to compile to link your program.
5. No other third-party libraries should be used in the program except SDL. The code has to be in C/C++.

Marking Scheme

1. Zero marks may be graded if your code is not compliable using the supplied *Makefile*.
2. Program structure, comments and usability (3%)
3. Encoding (6%)
4. Decoding (4%)
5. Calculation of SNR (2%)

Submission

Zip all source files to ***your_login_name.zip*** and submit the zip file.

IMPORTANT: DO NOT include and submit any object files and images in the zip file. Your submission may not be accepted if you do so.