In [ ]:
```
import numpy as np
import pandas as pd
```

In [ ]:
```
DEFAULT_QUANTIZATION = 8
grey_levels = [0, 50, 120, 200]
```

In [ ]:
```
#sort (convention)
sorted(grey_levels)
grey_levels
```

Out[ ]:
```
[0, 50, 120, 200]
```

In [ ]:
```
new_quant = int(np.ceil(np.log2(len(grey_levels))))
print(f"number of bits needed (Nb) = {new_quant}")
```

```
number of bits needed (Nb) = 2
```

In [ ]:
```
#coding
codewords = []

for i in range(len(grey_levels)):
    codewords.append(np.binary_repr(i, width=new_quant))
```

In [ ]:
```
codewords
```

Out[ ]:
```
['00', '01', '10', '11']
```

Encoding table

In [ ]:
```
#[ [index, graylevel, codeword] ]

table = []
for i in range(len(grey_levels)):
    table.append([i, grey_levels[i], codewords[i]])
```

In [ ]:
```
df = pd.DataFrame(table, columns=['Index', 'Gray Level', 'Codeword'])
```

In [ ]:
```
df
```

Out[ ]:

	Index	Gray Level	Codeword
0	0	0	00
1	1	50	01
2	2	120	10
3	3	200	11

Usage

In [ ]:
```
file = [0, 0, 50, 120, 120, 120, 200]
```

In [ ]:
```
compressed_file = []
for symbol in file:
    index = df.index[df['Gray Level'] == symbol].tolist()[0]
    compressed_file.append(df['Codeword'].iloc[index])
```

In [ ]:
```
compressed_file
```

Out[ ]:
```
['00', '00', '01', '10', '10', '10', '11']
```

In [ ]:
```
string = ""

for code in compressed_file:
    string += code
print(string)
```

```
00000110101011
```

compression ratio

In [ ]:
```
original_size = len(file) * DEFAULT_QUANTIZATION
compressed_size = len(compressed_file) * new_quant

compression_ratio = original_size / compressed_size
print(f"Compression ratio (Cr) = {compression_ratio}")
```

```
Compression ratio (Cr) = 4.0
```