

```

In [2]: from PIL import Image
import numpy as np

path = 'CMU_Grayscale.png'
img = Image.open(path).convert('L')
img.show()
img_matrix = np.array(img)

def compress(image_array, factor):
    # Perform SVD on the image
    U, S, V = np.linalg.svd(image_array, full_matrices=False)

    # Number of singular values to keep
    k = int(factor * len(S))
    print("Number of singular values used: ", k)

    # Reconstruct the image using the first k singular values
    S_k = np.diag(S[:k])
    U_k = U[:, :k]
    Vt_k = V[:k, :]

    compressed_image = np.dot(np.dot(U_k, S_k), Vt_k)

    return compressed_image

factors = [0.5, 0.1, 0.05]

for ratio in factors:
    compressed_image = compress(img_matrix, ratio)
    image_array_clipped = np.clip(compressed_image, 0, 255).astype(np.uint8)

    filename = f'compressed_{int(ratio * 100)}.png'
    Image.fromarray(image_array_clipped).save(filename)

```

```

Number of singular values used: 337
Number of singular values used: 67
Number of singular values used: 33

```