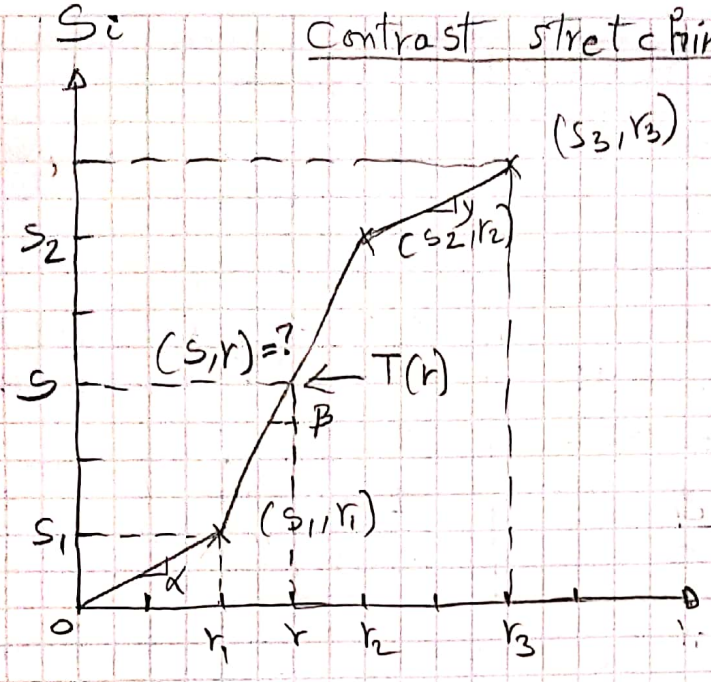
## Contrast stretching




by definition.

$$S = \begin{cases} \alpha r = \left(\frac{S_1 - S_0}{r_1 - r_0}\right) r \\ \beta (r - r_1) + S_1 = \frac{S_2 - S_1}{r_2 - r_1}(r - r_1) + S_1 = 0 \end{cases}$$

Thus our formula is:

$$\boxed{S = \frac{S_2 - S_1}{r_2 - r_1}(r - r_1) + S_1}$$

## Histogram equalization

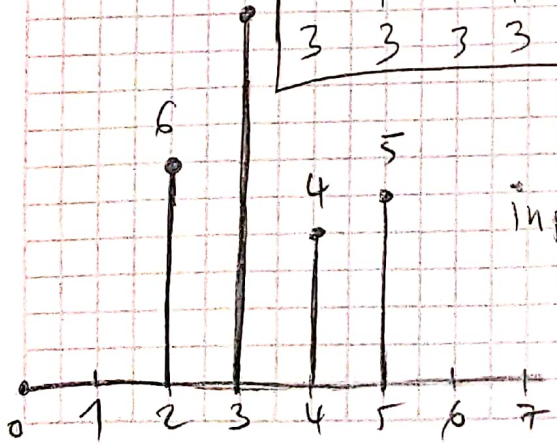
$$f(x,y) = \begin{bmatrix} 3 & 3 & 3 & 3 & 3 \\ 2 & 4 & 5 & 4 & 2 \\ 2 & 5 & 5 & 5 & 2 \\ 2 & 4 & 5 & 4 & 2 \\ 3 & 3 & 3 & 3 & 3 \end{bmatrix}$$

| Gray level | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| no of Pixels $n_k$ | 0 | 0 | 6 | 10 | 4 | 5 | 0 | 0 |

highest gray level 5 = 101

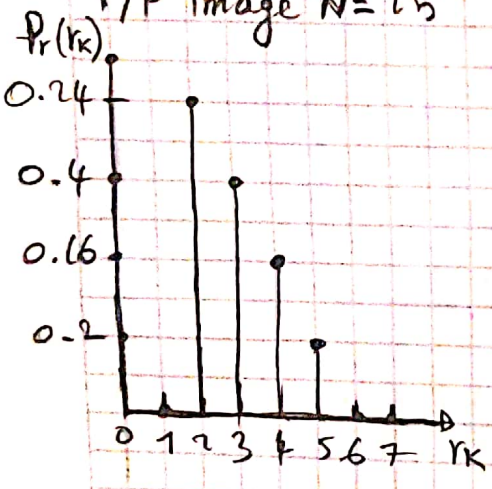
$a^3 = 8 \rightarrow$ 3bits [0, to 7]

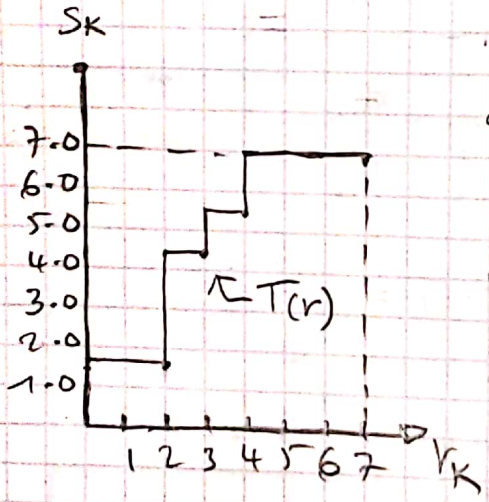
input histogram:

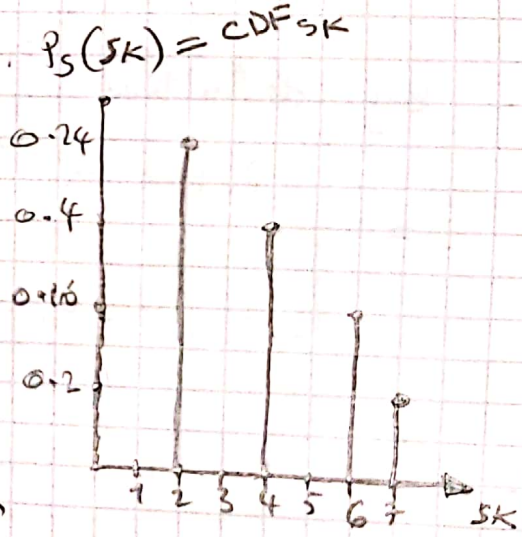


| $r_k$ | $n_k$ | $P_r(r_k) = n_k/MN$ | CDF $S_k$ | $S_k \times 7$ | Histogram equalization |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 6 | $6/25 = 0.24$ | 0.24 | 1.68 | $\approx$ 2 |
| 3 | 10 | $10/25 = 0.4$ | 0.64 | 4.48 | $\approx$ 4 |
| 4 | 4 | $4/25 = 0.16$ | 0.80 | 5.6 | $\approx$ 6 |
| 5 | 5 | $5/25 = 0.2$ | 1.0 | 7 | 7 |
| 6 | 0 | 0 | 1.0 | 7 | 7 |
| 7 | 0 | 0 | 1.0 | 7 | 7 |

i/p image N=25




(2)