Python Programming 2D-1D Mappings

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2D and 1D Flatten Relationships

- Let's say we have this 3x4 matrix
- We can flatten to

```
flst = [8, 16, 9, 52, 3, 15, 27, 6, 14, 25, 2, 10]
```

- We want to learn the indices relations
 - $|st[0][3] = 52 \Rightarrow is same as \Rightarrow f[st[3]]$
 - $lst[1][0] = 3 \Rightarrow is same as \Rightarrow flst[4]$
 - $lst[1][2] = 27 \Rightarrow is same as \Rightarrow flst[6]$
- For an NxM grid:
 - Given index (i, j), convert to its corresponding 1D flat index? E.g. (1, 0) \Rightarrow 4
 - O Given index i in 1D flat index, convert to its corresponding 2D (i, j)? $4 \Rightarrow (1, 0)$

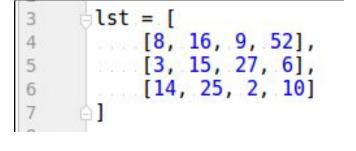
Find the equations

```
def from2d to 1d(cols, i, j):...
def fromld to 2d(cols, idx):...
def list relations(rows = 3, cols = 5):
    idx = 0
    for r in range(rows):
        for c in range(cols):
           print(f'({r}, {c}) ==> {idx}')
           assert (r, c) == fromld to 2d(cols, idx)
            assert idx == from2d to 1d(cols, r, c)
         idx += 1
list relations(3, 5)
```

3 Equations

- flst = [8, 16, 9, 52, 3, 15, 27, 6, 14, 25, 2, 10]
- To convert from (i, j) in matrix to 1D array

```
    i * COLS + j
    (1, 2) ⇒ 1 * 4 + 2 = 6
```



- To convert from index in 1D array to (i, j) in matrix
 - \circ i = idx//COLS j = idx%COLS

 - \circ Why? Idx = i * COLS + j
 - Idx // COLS = (i * COLS + j) // COLS = i + 0, as j < COLS
 - Idx % COLS = (i * COLS + j)%COLS = 0 + j, as j < COLS and (i*COLS)%COLS = 0

"Acquire knowledge and impart it to the people."

"Seek knowledge from the Cradle to the Grave."