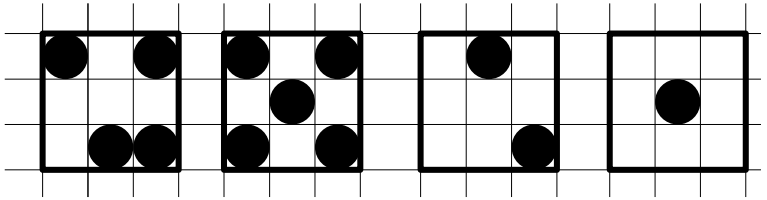
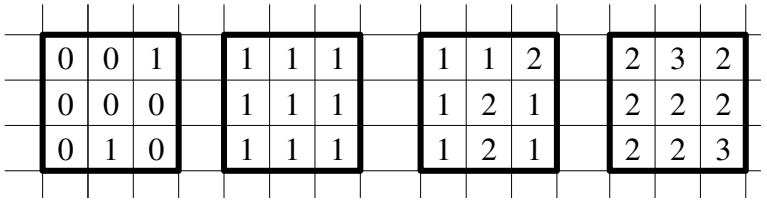
Exercise Computer graphics – (till April 21, 2009)

Ordered dithering

Exercise 11: Ordered dithering meant that a gray value is approximated by different patterns like these:



For imaging devices being able to display a small number of gray levels, an extension was proposed that does not only consist of black and white pixels like shown above but that consists of shades of gray.



Explain how to map gray values to these patterns if the resolution of an image must not be increased.

Exercise Computer graphics

Bi-level display of gray-images

Exercise 12: (a) The 8x4 image below is to be rendered using the same pattern as before. However, the image size of 8x4 should be preserved using the modulo-technique. The rule is that a pixel will be set if the value in the pattern is smaller or equal to the gray level which should be displayed.

Image:

```
10  4 12 12 10  6  3  7
10  5 12 12  6 15  9 11
 8  9 12 12 12  4 10 15
 9 10  1  0  1  5 11  1
```

Solution should look like this:

```
 ?  ?  ?  ?  ?  ?  ?  ?
 ?  ?  ?  ?  .  ?  ?  ?
 ?  *  ?  ?  ?  ?  ?  ?
 ?  ?  ?  ?  ?  ?  *  ?
```

pixel set = *
pixel clear = .
fill out yourself = ?

Pattern:

```
16  5  6  7
15  4  1  8
14  3  2  9
13 12 11 10
```

Exercise Computer graphics

Bi-level display of gray-images

Exercise 12: (b)

The simplest approach to approximate gray levels is to replace each pixel of an image with gray values by an entire dithering patter if the resolution of the output device allows for that. This will obviously preserve the mean gray value of the original image.

Does this also hold true for the modulo approach in which to output resolution is equal to the resolution of the input image? Explain why.