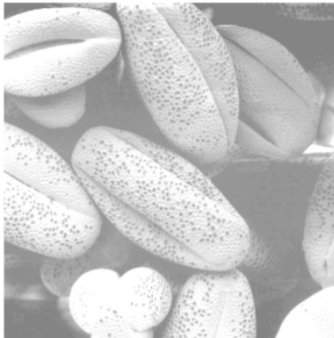


## Question xx. Image Processing

The following figures include one original grey-level image and the results of applying different standard processes to it. For each of the output images (b) to (d), select one process out of the given possible selections, which has been used to obtain it from the original image. **For each selection, please briefly describe the visual effects.**

Possible Processes: (1) Gaussian Smooth; (2) Histogram Equalization; (3) Salt & Pepper Noise; (4) Butterworth High Pass Filter; (5) Image Thresholding; and (6) Image Integration.

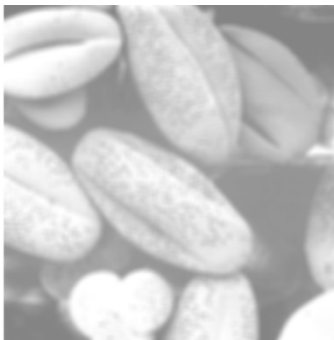


(a)



(b)

Source: <http://www.imageprocessingplace.com>



(c)



(d)

Answers:

(b)

(c)

(d)

### Question xx. Alpha-trimmed mean filter

If we remove the  $d/2$  lowest and  $d/2$  highest gray-level values of a noisy image  $g(s, t)$  in the area  $S_{xy}$  (which is a  $m \times n$  window) and yield a subset  $T_{xy}$ , the alpha-trimmed mean filter can be defined as follows,

$$\hat{f}(x, y) = \frac{1}{mn - d} \sum_{(s,t) \in T_{xy}} g(s, t)$$

With what value of  $d$  is the filter equivalent to an arithmetic mean filter? (2%)

With what value of  $d$  is the filter equivalent to a median filter? (2%)

Perform alpha-trimmed mean filtering on the following image using  $d = 4$ ,  $m=3$ ,  $n=3$ . (6%)

Input Image				
0	33	27	0	41
39	0	0	22	28
10	31	18	32	12

Output Image				
*	*	*	*	*
*				*
*	*	*	*	*

**Remark: Fill in all pixels with the output of the alpha-trimmed mean filter. Do not leave any pixel blank. Boundary pixels of output image are set to \* and you do not need to consider those ones. Round your answers to the nearest integer.**