

- 1) A perfect low pass filter should be a box filter in the frequency domain.
 - a) However, this is not achievable in practice. Why?
 - b) The popular way of low pass filtering is to use a box filter in spatial domain. However this is not a perfect low pass filter. Why?
 - c) What kind of low pass filter alleviates the problem of the above filters?
 - d) What is its shortcoming when compared to the perfect low pass filter?

- 2) To achieve a low pass filter, you are convolving an 1D input signal of size N with a box filter of size M in the spatial domain.
 - a) How many floating point operations would you need to achieve this convolution in the spatial domain? Justify your answer.
 - b) What would you do to achieve the low pass filtering in a more efficient manner using frequency domain operations?
 - c) What kind of precautions do you need to take while implementing this operation to avoid aliasing artifacts? Describe in details.

- 3) You want to digitize an analog signal of bandwidth 120Hz. The sampling frequency of your display is 80 Hz. The bandwidth of your reconstruction kernel is 100 Hz.
 - a) Why won't you be able to sample and reconstruct this signal without artifacts using this display?
 - b) How would you process the image to sample it without any artifacts?
 - c) What kind of artifacts would the reconstruction kernel generate?
 - d) How would you change the reconstruction kernel to correct it?

- 4) What is a Morovac filter? What does it measure? What are some undesirable properties of the Morovac operator?

- 5) Consider an image with salt and pepper noise. If you use a Gaussian filter to remove this noise, what shortcoming does it have? What will be a better filter for this purpose?

- 6) What is the relationship between the genus and the euler characteristics of a mesh? What is the genus of a sphere? Can a torus be morphed into a sphere? Justify your answer.