Overview (1):

- Material You are Responsible For
  - Sections covered

- Some Notes Regarding “Important Topics”
  - What is an edge?
  - Spatial filtering example

Material You are Responsible For (1):

- Chapters and Sections Covered in the Exam
  - Chapter 1
    - All sections
    - Easy read → you should know the basic definitions such as, what is an image, what is digital image processing and should be aware of some of the fields that use image processing
  - Chapter 2
    - Section 2.1: elements of visual perception → you should know some of the basic definitions related to the eye and image formation, in particular, focus on lecture notes
Material You are Responsible For (2):

- Chapters and Sections Covered in the Exam
  - Chapter 2
    - Section 2.2: light and the electromagnetic spectrum → you should know what the EM is
    - Section 2.3, 2.3.1, 2.3.2, 2.3.3, 2.3.4: image sensing and acquisition → important!
    - Section 2.4, 2.4.1, 2.4.2: image sampling and quantization → important!
    - Section 2.5, 2.5.1, 2.2, 2.5.3, 2.5.4: Basic relationships between pixels → important!
    - Section 2.6: Linear and non-linear operators → know definitions of (non)linear operator!

Material You are Responsible For (3):

- Chapters and Sections Covered in the Exam
  - Chapter 3
    - Section 3.1: background
    - Section 3.2, 3.2.1, 3.2.2, 3.2.3, 3.2.4: basic gray level transformations → you should be familiar with the various transformations we covered in the lectures
    - Section 3.3 (up to page 90 only): histogram processing → you should know what a histogram, how to construct one and how to normalize one
    - Section 3.4, 3.4.1: Enhancement using arithmetic and logic operators

Material You are Responsible For (4):

- Chapters and Sections Covered in the Exam
  - Chapter 3 (cont...)
    - Section 3.5: Basics of spatial filtering → you should know what a mask (template, kernel) is, what the coefficients are and coordinate system of the mask e.g., origin at (0,0)
    - Section 3.6, 3.6.1, 3.6.2: Smoothing spatial filters → important!
    - Section 3.7, 3.7.1 (up to page 125) → important!
    - Spatial filtering is important!
Material You are Responsible For (5):
- Important Material
  - You are responsible for all sections we covered as listed in the previous slides.
  - Although the notes do contain plenty of information and probably the most important information, keep in mind, you are also responsible for the material in the corresponding sections in book → I cannot include every piece of information from the book in the lecture slides!
  - Spatial filtering is a very important topic and you should know how to filter an image using a mask

Material You are Responsible For (5):
- Important Material (cont.)
  - You are responsible for knowing Matlab at least with respect to the Labs we have already completed.
  - Creating matrices in Matlab
  - Now you should realize the importance of completing the Matlab review exercise!

Additional Notes
Spatial Filtering Example (1):

- Spatial Filtering Mechanics
  - Consider the following sub-image intensity values
  - We wish to perform a blurring (averaging) operations using the kernel shown below
  - Let's work through the operation for one pixel (the shaded pixel)

```
  15  12  30  45  125
  220 200 110  90  40
  100 100 100  0  125
  10  30  25  120  15
```

Spatial Filtering Example (2):

- Spatial Filtering Mechanics (cont...)
  - Recall the following expression
    \[
    R = w(-1,-1)f(x-1,y-1) + w(-1,0)f(x-1,y) + \ldots + w(0,0)f(x,y) + \ldots + w(1,0)f(x+1,y) + w(1,1)f(x+1,y+1)
    \]
  - Or, its equivalent "shorter" notation
    \[
    g(x,y) = \sum_{a=-1}^{1} \sum_{b=-1}^{1} w(a,b)f(x+a,y+b)
    \]

Spatial Filtering Example (3):

- Spatial Filtering Mechanics (cont...)
  \[
  g(x,y) = \frac{1}{91}(10) \cdot \frac{1}{9}(12) \cdot \frac{1}{9}(50) \cdot (1) \cdot (10) \cdot \frac{1}{9}(100) \cdot (1) \cdot (225) \cdot (1) \cdot (200) \cdot (1) \cdot (210)
  \]
  \[
  = \frac{1}{9} \times [822]
  \]
  \[
  = 91.3 \approx 91 \quad \text{(recall, integer intensity values!)}
  \]
Spatial Filtering Example (4):

- How About Median Operation on the Same Sub-Image ?
- How would we perform a median operation on the same pixel (shaded one) ?

Good Luck!