FUNDAMENTALS OF COMPUTER VISION – 1ST PARTIAL EXAM NOVEMBER 3RD 2022

Name and Surname:

NIA

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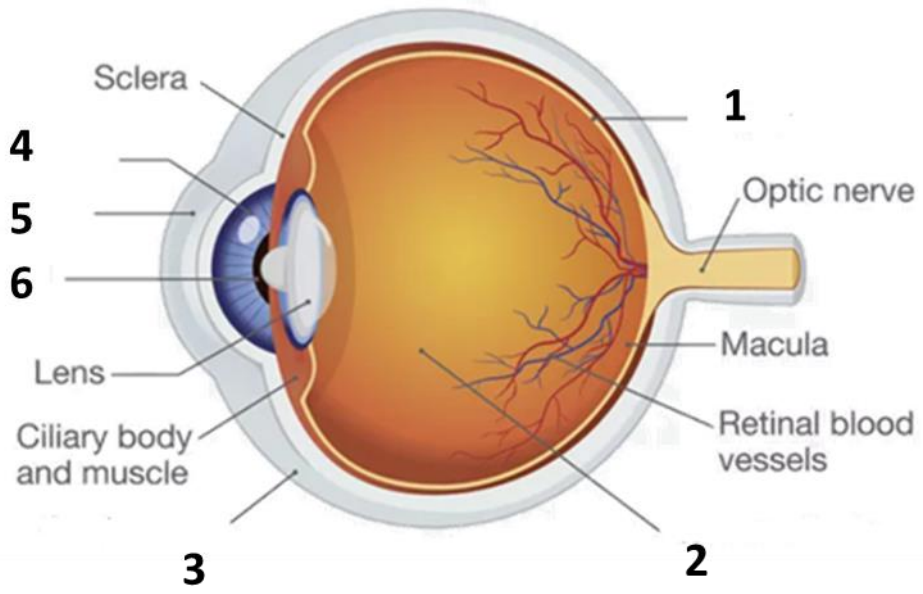
**1 (1.5 points). Please fill the gaps in the following human eye representation**




| | |
|---|---|
| 1 | RETINA |
| 2 | VITREOUS BODY |
| 3 | CONJUNCTIVA |
| 4 | IRIS |
| 5 | CORNEA |
| 6 | PUPIL |

**2 (1 point). Is the following sentence true? If it is not the case, can you explain why?**

**"The greater focal distance, the larger the field of view"**

**FALSE**

**"THE GREATER FOCAL DISTANCE, THE LESS THE FIELD OF VIEW"**

**Less part of the scene is covered with less angle**

**3 (1 point). Please provide a brief explanation of the following concepts: sampling and quantization. Which order of values should we have (low, mid, high) if we want to have a highly detailed image with reasonable size?**

- **Sampling: discretization in space. This happens because of acquiring a continuous signal from real world with a discrete sensor.**
- **Quantization: discretization in amplitude / weight. It is generated as we store the information in a digital format (8 bits, 16 bits)**
- **High sampling, mid quantization**

**4 (1 point). What do logarithm and look up table operations have in common? Please provide a brief explanation of both operations. Include what they are used commonly for.**

- **Non linear transformations**
- **Logarithmic: enhancement of dark pixels without saturating bright pixels**
- **LUT:**
  - **LUT defines a vector whose values indicate the expected output for a given input value.**
  - **Pixel values of the original input image index the new values**

**5 (1 point) What is image subtraction? Please provide a case of use of image subtraction different than the one we used at class.**

- **Subtracting two images**
- **Used for:**
  - **Movement (or absence of it) detection**
  - **• Remove the part of the image that does not change**
  - **• Reduce information, sequence compression**

**6. (1 point) Perform the following convolution operation. Calculate only the values of the positions marked in the original matrix.**

| | | | | |
|---|---|---|---|---|
| 3 | 3 | 2 | 5 | 1 |
| 4 | 3 | 4 | 6 | 3 |
| 4 | 6 | 7 | 2 | 5 |
| 7 | 2 | 2 | 4 | 2 |
| 3 | 4 | 5 | 6 | 6 |

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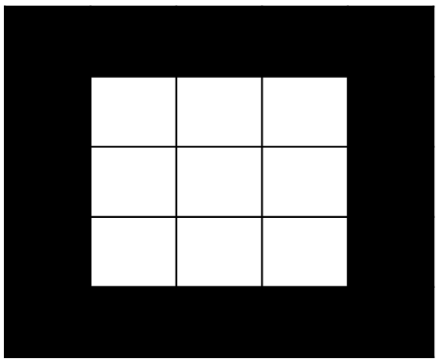
| | | |
|---|---|---|
| 2 | 1 | 4 |
| 5 | 3 | 7 |
| 6 | 2 | 8 |

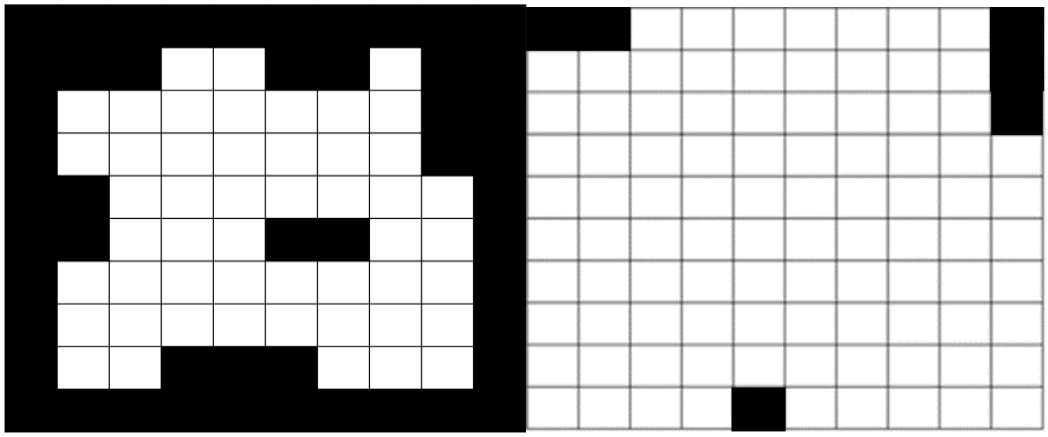
| | | | | |
|---|---|---|---|---|
| **34** | **67** | **80** | **62** | **65** |
| **67** | **135** | **156** | **133** | **106** |
| **79** | **177** | **159** | **158** | **101** |
| **86** | **177** | **147** | **164** | **90** |
| **55** | **130** | **117** | **119** | **96** |

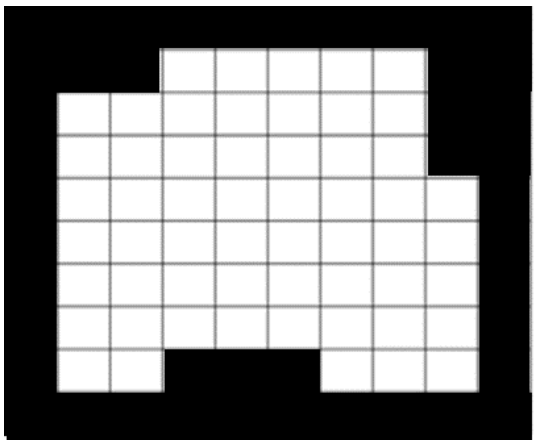
**7 (1 point) What is correlation? Why do we use it in image processing? What's its relationship with convolution operator?**

- **A linear system**
- **Similar to convolution but without reflecting the h kernel**
- **Used to see similarity between images and images with respect to patches**

**8 (1.5 points). Perform closing operation over the following binary image using the following structure element**







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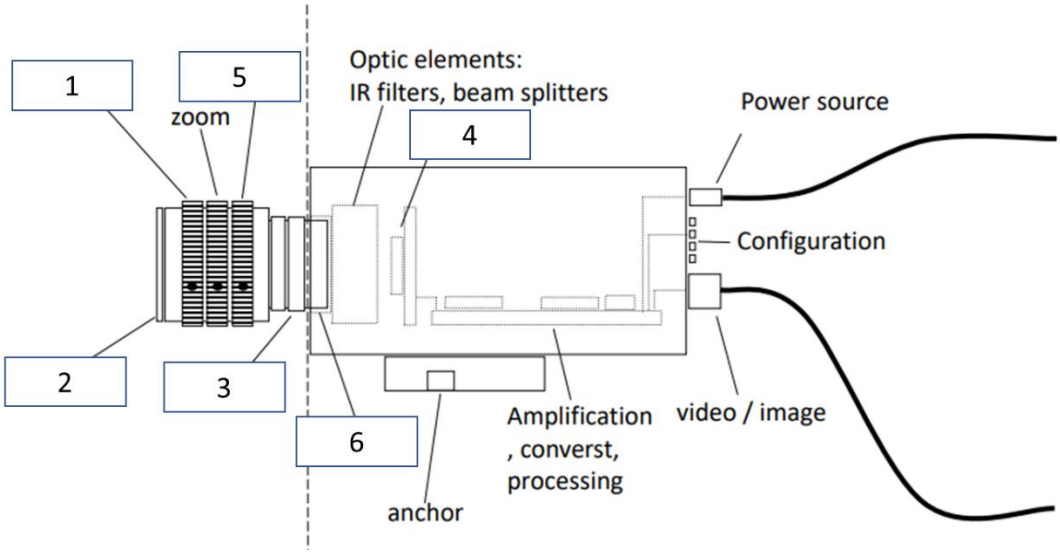
**9 (1 point) Explain what watersheds are. Why do we use them? What are their biggest drawbacks? How do we solve them?**

- **Lines that separate the different catchment basins**
- **Image segmentation**
- **Oversegmentation**
- **Morphological gradient, Watershed with markers**

**EXTRA (1 point) Complete the following picture depicting the parts of a camera**




| | |
|---|---|
| **1** | **FOCUS** |
| **2** | **FILTERS** |
| **3** | **EXTENSORS** |
| **4** | **SENSORS** |
| **5** | **DIAFRAGM** |
| **6** | **MOUNT** |