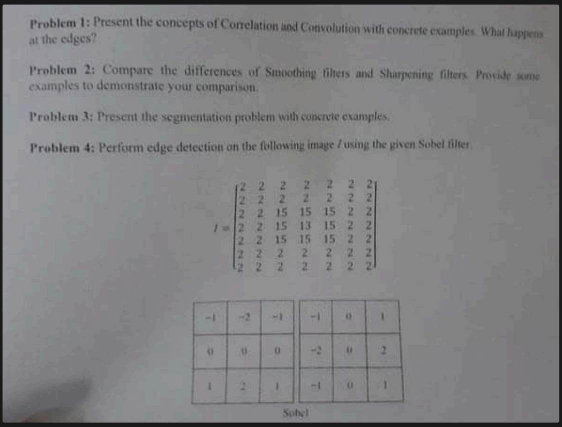
2020 Gen 9 Final



Problem 1: Present the concepts of Correlation and Convolution with concrete examples. What happens at the edges?

Problem 2: Compare the differences of Smoothing filters and Sharpening filters. Provide some examples to demonstrate your comparison.

Problem 3: Present the segmentation problem with concrete examples.

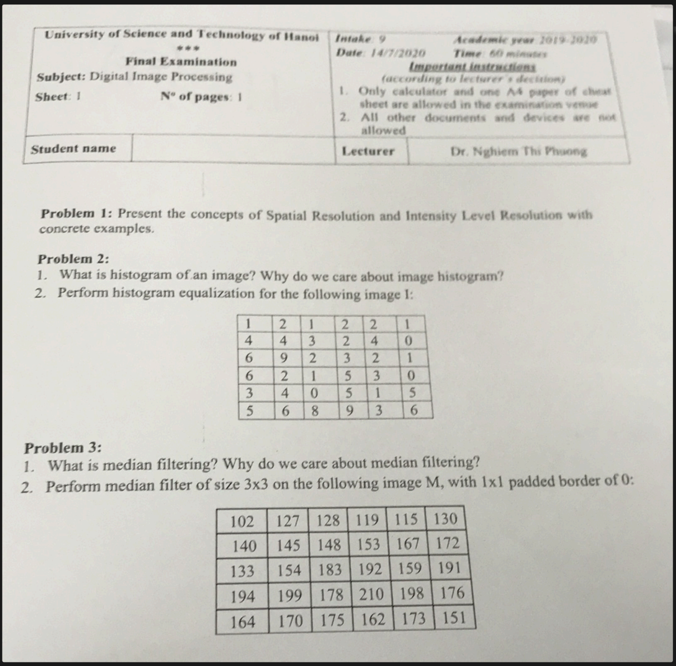
Problem 4: Perform edge detection on the following image *I* using the given Sobel filter.

$$I = \begin{bmatrix} 2 & 2 & 2 & 2 & 2 & 2 & 2 \\ 2 & 2 & 2 & 2 & 2 & 2 & 2 \\ 2 & 2 & 15 & 15 & 15 & 2 & 2 \\ 2 & 2 & 15 & 13 & 15 & 2 & 2 \\ 2 & 2 & 15 & 15 & 15 & 2 & 2 \\ 2 & 2 & 2 & 2 & 2 & 2 & 2 \\ 2 & 2 & 2 & 2 & 2 & 2 & 2 \end{bmatrix}$$

-1	-2	-1
0	0	0
1	2	1

-1	0	1
-2	0	2
-1	0	1

Sobel



University of Science and Technology of Hanoi *** **Final Examination** **Subject:** Digital Image Processing **Sheet**: 1 **N° of pages**: 1	***Intake***: 9 ***Academic year*** 2019-2020 ***Date***: 14/7/2020 ***Time***: 60 minutes ***Important instructions*** *(according to lecturer's decision)* 1. Only calculator and one A4 paper of cheat sheet are allowed in the examination venue 2. All other documents and devices are not allowed
Student name	**Lecturer** Dr. Nghiem Thi Phuong

Problem 1: Present the concepts of Spatial Resolution and Intensity Level Resolution with concrete examples.

Problem 2:
1. What is histogram of an image? Why do we care about image histogram?
2. Perform histogram equalization for the following image I:

1	2	1	2	2	1
4	4	3	2	4	0
6	9	2	3	2	1
6	2	1	5	3	0
3	4	0	5	1	5
5	6	8	9	3	6

Problem 3:
1. What is median filtering? Why do we care about median filtering?
2. Perform median filter of size 3x3 on the following image M, with 1x1 padded border of 0:

102	127	128	119	115	130
140	145	148	153	167	172
133	154	183	192	159	191
194	199	178	210	198	176
164	170	175	162	173	151

1. Present the concepts of Correlation and Convolution with concrete examples. What happens at the edges?
2. Compare the differences of Smoothing filters and Sharpening filters. Provide some examples to demonstrate your comparison.
3. Present the segmentation problem with concrete examples.
4. Perform edge detection on the following image I using the given Sobel filter.

$$I = \begin{bmatrix} 2 & 2 & 2 & 2 & 2 & 2 \\ 2 & 2 & 2 & 2 & 2 & 2 \\ 2 & 2 & 15 & 15 & 15 & 2 \\ 2 & 2 & 15 & 15 & 15 & 2 \\ 2 & 2 & 15 & 15 & 15 & 2 \\ 2 & 2 & 2 & 2 & 2 & 2 \\ 2 & 2 & 2 & 2 & 2 & 2 \end{bmatrix}$$

$$\begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix} \qquad \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}$$

Problem 1

Present the concepts of Spatial Resolution and Intensity Level Resolution with concrete examples.

Problem 2

- What is histogram of an image? Why do we care about image histogram?
- Perform histogram equalization on the following image I.

$$I = \begin{bmatrix} 1 & 2 & 1 & 2 & 2 & 1 \\ 4 & 4 & 3 & 2 & 4 & 0 \\ 6 & 9 & 2 & 3 & 2 & 1 \\ 6 & 2 & 1 & 5 & 3 & 0 \\ 3 & 4 & 0 & 5 & 1 & 5 \\ 5 & 6 & 8 & 9 & 3 & 6 \end{bmatrix}$$

- What is median filtering? Why do we care about median filtering?
- Perform median filtering of size 3x3 on the following image M, with 1x1 padded border of 0:

$$M = \begin{bmatrix} 102 & 127 & 128 & 119 & 115 & 130 \\ 140 & 145 & 148 & 153 & 167 & 172 \\ 133 & 154 & 183 & 192 & 159 & 191 \\ 194 & 199 & 178 & 210 & 198 & 176 \\ 164 & 170 & 175 & 162 & 173 & 151 \end{bmatrix}$$

[redacted]