

**Computer Science and Engineering 4422.03/5323.03**

**Test**  
June 30 2021

**Answer all questions in the space provided**

**Make sure that you have 1 pages**

Student Last Name: \_\_\_\_\_

Student Given Name: \_\_\_\_\_

Student Id. No: \_\_\_\_\_

Question	Value	Score
1	20	
2	20	
3	20	

**Question 1.** [20 points]

Consult the notes for rotation matrices (and may be wikipedia) and try to simplify

$$S^T R S$$

and express it in terms of the elements of vector  $s$ . You may want to use a symbolic algebra package like Maple or xmaxima.

**Question 2.**

[20 points]

Fit a quadratic to an 1-D image  $I$  at points  $I[i - 1]$ ,  $I[i]$  and  $I[i + 1]$  so that

$$I[i + x] = a[i]x^2 + b[i]x + c[i]$$

Express the parameters  $a$ ,  $b$  and  $c$  as convolutions. As a bonus can you fit it to more points  $I[i = k] \cdots I[i + k]$  in the least squares sense?

**Question 3.**

[20 points]

Consult wikipedia and show that convolution with the Gabor function can be expressed as the sum of two separable convolutions.