

## Lab 3. Task 1- preparation task

### Template for answers

**Save this document as a .pdf document before submitting.**

*Student names and LiU-IDs: (Max 2 students per group):*

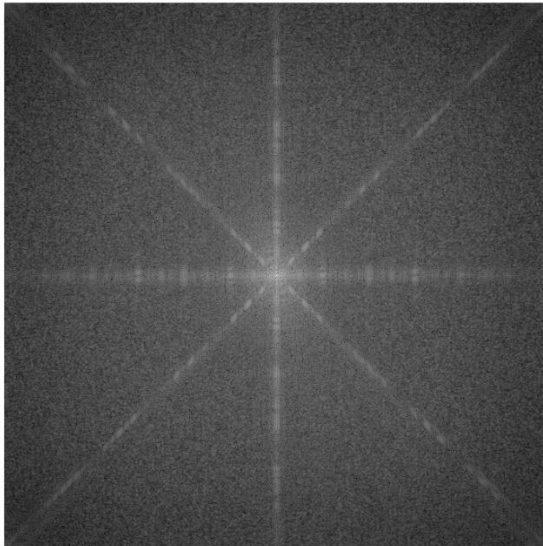
1. *Thomas Indrias (thoin216)*

*Submission date: 2018-12-7*

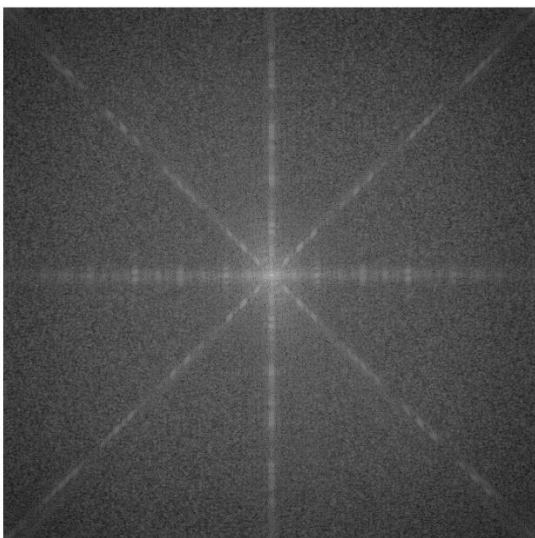
*Version (in case you need to re-submit): 1.0*

### 1) 2D Fourier spectrum

**1)** Spec1:



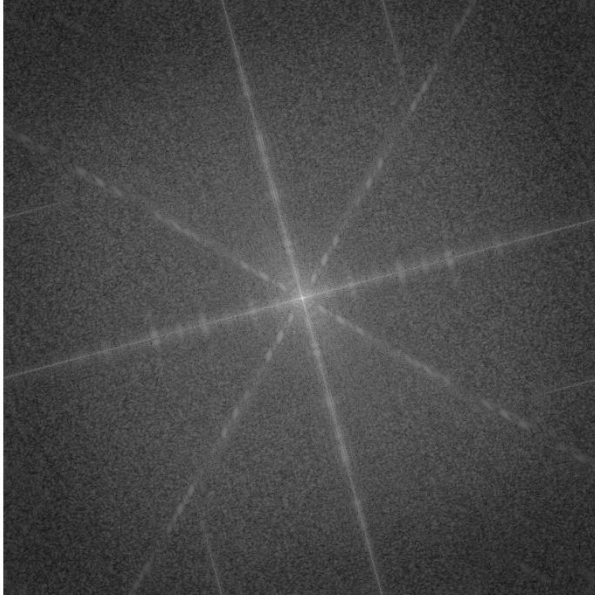
**2)** Spec2:



3) Are there any differences between *Spec2* and *Spec1*? How does shift affect the spectrum of the Fourier transform?

%There is not a big different that can be seen. The translation has no effect on the magnitude of the spectrogram.

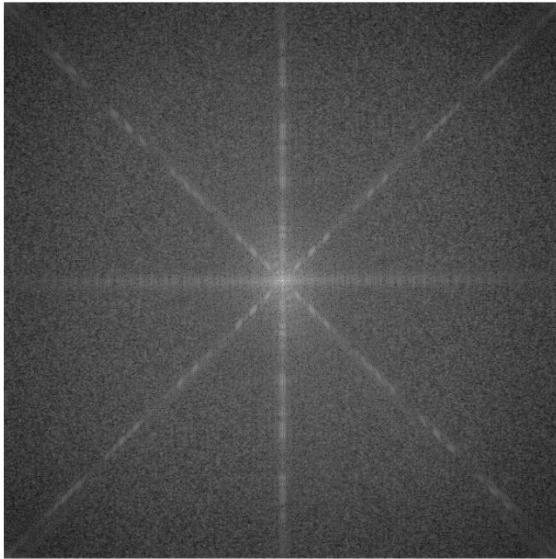
4) Spec3:



5) Are there any differences between *Spec3* and *Spec1*? How does rotation in the spatial domain affect the Fourier spectrum? (Ignore some distortions caused by the black area around the image after rotation (*cTP\_rot*))

% Yes, we can see that the spectrum for Spec 3 is rotated. It can be said  
% that if the image is rotated, the spectrum of the image will be rotated  
% with the same angle.

6) Spec4:



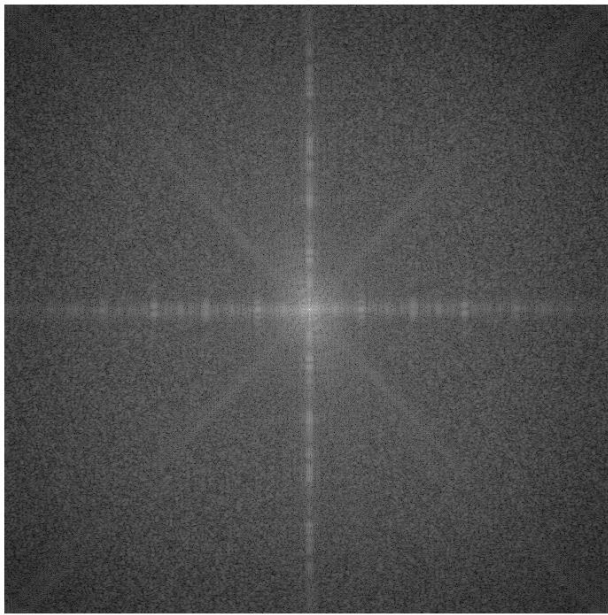
7) Compare *Spec4* and *Spec1* and explain how the elimination of vertical bars affected the spectrum. **HINT:** Look specially at the **horizontal** axes of the spectrum.

```
%The vertical lines in the image results to more detail in the horizontal
%axis (periodicity) and less in the vertical axis. This can be seen in
%Spec1 and Spec4. The spectrum, spec1 shows that there is more details in
%the horizontal axis. In spec4 (without the vertical lines in the image) we
%can see that there is less detail in the horizontal axis because there is
%no more variance from the vertical lines in the image.
```

8) Explain what would happen to the spectrum if the horizontal bars were eliminated from *cTP*?

```
%In this case, there would be less detail in the horizontal axis
%resulting to a spectrum with less magnitude in the vertical axis.
```

9) Spec5:



10) Compare *Spec5* and *Spec1* and explain how the elimination of diagonal bars affected the spectrum. **HINT:** Look specially at the diagonal axes of the spectrum.

```
%The same principle applies here. Since we removed the diagonal lines.  
%There will be less detail in the diagonal axis in the spectrogram.
```

## 2) Period and Frequency

11) Where would these three dominant peaks appear if *v2* is transposed, i.e. if the vertical bars become horizontal?

```
%If we transpose, we rotate the image 90 degrees clockwise meaning that we  
%will have a point on the top of the spectrum and in the centrum. Also one  
%on the bottom but since v2 has even size, it is not visible.
```

12) What is the frequency of these stripes? Where would the three dominant peaks in the spectrum for this image appear?

```
%Frequency = 0.25 cycles/pixel  
%It would appear +/- 1/2 from the centrum on the horizontal axis in the  
%spectrum.
```

13) What is the frequency of these stripes? Where would the three most dominant peaks in the spectrum for this image appear?

```
%Frequency = 0.0033 cycles/pixel  
%It would appear +/- 1/150 from the centrum on the horizontal axis in the  
%spectrum.
```

### 3) The importance of the spectrum and the phase angle

14) E1\_E2:



15) E2\_E1:



16) Is the spectrum or the phase angle that has more effect on the structure of an image based on your visual analysis of the above results?

%It is the phase angle that has the biggest impact on the structure which  
%can be seen in the previous tasks. The image corresponding the respective  
%phase angle dominates the transformed image.

*Don't forget to save the document as .pdf before submitting!*