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DUBLIN CITY UNIVERSITY

SAMPLE PAPER 2015/2016

MODULE: CA4007 – Computer Graphics and Image Processing

PROGRAMME(S):

        CASE   BSc in Computer Applications (Sft.Eng.)
        ECSA   Study Abroad (Engineering & Computing)

YEAR OF STUDY: 4,X

EXAMINERS:

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TIME ALLOWED: 3 Hours

INSTRUCTIONS: Answer two questions from Section 1 and two questions from Section 2. All questions carry equal marks.

PLEASE DO NOT TURN OVER THIS PAGE UNTIL YOU ARE INSTRUCTED TO DO SO
The use of programmable or text storing calculators is expressly forbidden.
Please note that where a candidate answers more than the required number of questions, the examiner will mark all questions attempted and then select the highest scoring ones.

Requirements for this paper (Please mark (X) as appropriate)

	Log Tables		*Thermodynamic Tables*
	Graph Paper		*Actuarial Tables*
	Dictionaries		*MCQ Only – Do not publish*
	Statistical Tables		*Attached Answer Sheet*

SECTION 1 IMAGE PROCESSING

QUESTION 1   **[TOTAL MARKS: 25]**

Q 1(a)   **[4 Marks]**

Using Matlab load the following file

```
load 'p:\\public\\alistair\\fence'
```

which consists of an image of a wire fence with a wall behind it.

Using Matlab compute the Fourier Transform of the image and display the log of it on your screen. Sketch it in your exam booklet.

Q 1(b)   **[9 Marks]**

Which parts of the Fourier Transform correspond to the fence and which correspond to the wall? Explain why.

Q 1(c)   **[6 Marks]**

Using Matlab set the values of the areas corresponding to the wall in the Fourier Transform to zero and then carry out an Inverse Transform. Write the commands you used to do this in your exam booklet.

Q 1(d)   **[6 Marks]**

Sketch the resulting image indicating any changes due to the filtering. What effect, if any, has the operation had on the fence? What other effects have there been on the image? Explain why.

[End of Question 1]

QUESTION 2 *[TOTAL MARKS: 25]*

Q 2(a) **[6 Marks]**
Using Matlab load the following files

```
load 'p:\\public\\alistair\\annulus'
```

which contains an image of a ring with thickness 20 pixels

```
load 'p:\\public\\alistair\\disc'
```

which contains an image of a disc with diameter 20 pixels.

How can you express the ring as a convolution of the disc with another shape? What is the other shape?

Q 2(b) **[6 Marks]**
Explain using the Convolution Theorem, how you can deconvolve the ring to obtain the other shape. Using Matlab, deconvolve the ring. Write the Matlab commands in your exam booklet.

Sketch the deconvolved image.

Q 2(c) **[6 Marks]**
Explain how you would adapt the technique you described in part (b) to allow for the effects of noise in the convolved image.

Q 2(d) **[7 Marks]**
Now load the following file

```
load 'p:\\public\\alistair\\annulusnoise'
```

which is the annulus file with added random white noise.

Using the technique you described in part (c) deconvolve the image. Write the Matlab commands you used to do this in your exam booklet.

Describe the restored image now. How does it differ from the restored image in part (b)? Explain why these effects happen.

[End of Question 2]

QUESTION 3   *[TOTAL MARKS: 25]*

Q 3(a)   **[6 Marks]**
Using Matlab load the following file

```
load 'p:\\public\\alistair\\squares'
```

which consists of a number of squares.

Using Matlab compute the Fourier Transform of the image and display the log of it on your screen. Sketch it in your exam booklet.

Explain the structure of the Fourier Transform.

Q 3(b)   **[6 Marks]**
In Matlab load the following file

```
load 'p:\\public\\alistair\\circmask'
```

which contains a binary mask for extracting edges in all directions.

Multiply the Fourier Transform of the `squares` image by your mask. Carry out an Inverse Transform and sketch the filtered image in your exam booklet.

Write the commands in your exam booklet.

What effects in the filtered image are due to the binary nature of the mask?

Q 3(c)   **[6 Marks]**
In Matlab create a Gaussian mask for extracting edges in all directions.

Multiply the Fourier Transform of the squares image by your mask. Carry out an Inverse Transform and sketch the filtered image in your exam booklet.

Write the commands in your exam booklet.

Point out the differences between this filtered image and the one in part 3(b).

Q 3(d)   **[7 Marks]**
Explain the differences between the two filtered images.

[End of Question 3]

SECTION 2 COMPUTER GRAPHICS

QUESTION 4   *[TOTAL MARKS: 25]*

Q 4(a)   **[12 Marks]**
Edit the example program `simple.c` and write a reshape function which maintains the square with the same aspect ratio when the window is resized. Save the program as `Reshape.c`

Q 4(b)   **[13 Marks]**
Add a menu to the previous program so that you can select the colour of the square from the menu. Save the program as `Reshape.c`

[End of Question 4]

QUESTION 5   *[TOTAL MARKS: 25]*

Q 5(a)   **[12 Marks]**
Edit the example program `simple.c` and write an idle function which causes the square to rotate about its centre. Save the program as `Idle.c`

Q 5(b)   **[13 Marks]**
Edit the previous program so that whenever you click the right mouse button the rotation changes direction. Save the program as `Idle.c`

[End of Question 5]

QUESTION 6   *[TOTAL MARKS: 25]*

Q 6(a)   **[12 Marks]**
Edit the example program `cube.c` to place a cylinder of height 1.0 and radius 0.5 at the origin with its axis along the y-axis. Save the program as `cylinder.c`

Q 6(b)   **[13 Marks]**
Edit the previous program to place a cuboid of length 1.0 and sides of length 0.2 on top of the cylinder. Save the program as `cylinder.c`

[End of Question 6]

[END OF EXAM]