UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

B. Sc. Examination 2012

Computer Science

IS51016A/12C/17A   Audio-Visual Computing, Audio-Visual Information Systems, Creative Audio-Visual Computing

Duration: 2 hours 15 minutes

Date and time:

There are three questions in this paper. You should answer all of them. Each question is marked out of 25. The marks for each part of a question are indicated at the end of the part in [.] brackets.

Electronic calculators must not be programmed prior to the examination. Calculators which display graphics, text or algebraic equations are not allowed.

THIS PAPER MUST NOT BE REMOVED
FROM THE EXAMINATION ROOM

Question 1

(a) In Audio Processing, what does a low pass filter do? [3]

    a) removes loud sounds

    b) removes quiet sounds

    c) removes low-frequency components of sounds

    d) removes high-frequency components of sounds

(b) If r, g and b are the red green an blue components of the original image pixel at location i, which of the following reduces the contrast of the image? [3]

    a) img.pixels[i] = color(r, g, b);

    b) img.pixels[i] = color(g, g, g);

    c) img.pixels[i] = color(r, 2*g, 2*b);

    d) img.pixels[i] = color(0.5*r, 0.5*g, 0.5*b);

(c) Which of the following could not be represented using sine waves? [3]

    a) A pattern of dirt on a surface

    b) A pure musical tone

    c) ripples in water

    d) slowly undulating hills

(d) You are writing a game with a space ship whose position is represented by a PVector called shipPos. It is moving towards a planet with position planetPos. Which code would you use to calculate the angle in which to turn it so it points in the in the direction of the planet? [3]

    a) float angle = atan2(shipPos, planetPos);

    b) float angle = cos(shipPos.x - planetPos.x, shipPos.y - planetPos.y);

    c) float angle = atan2(planetPos.y- shipPos.y, planetPos.x - shipPos.x);

    d) float angle = acos(planetPos.x - shipPos.x, planetPos.y - shipPos.y);

(e) You are going for an interview with a social media company that wants to implement image effects for their photo gallery. Describe how you would implement an image effect that would really impress them. [13]

Question 2

(a) What is a vector? [3]

    a) An array of pixels each of which is a colour value

    b) the pitch of an audio signal

    c) The corner of a shape drawn in 3D graphics

    d) A single representation of x and y coordinates

(b) If vel is the velocity of an object, which of the following lines of code simulates gravity? [3]

    a) vel.add(new PVector(0, 1));

    b) vel.mult(new PVector(1, 0));

    c) vel.mult(-0.465);

    d) vel.add(new PVector(1, 0));

(c) Which of the following processing commands you use when drawing a complex irregular shape? [3]

    a) vertex

    b) rect

    c) PVector

    d) filter

(d) Convert the vector $[1,4]$ from cartesian to polar coordinates. [3]

    a) $\begin{pmatrix} 5 \\ 90° \end{pmatrix}$

    b) $\begin{pmatrix} 4.123 \\ 75.96° \end{pmatrix}$

    c) $\begin{pmatrix} 3 \\ 35.64° \end{pmatrix}$

    d) $\begin{pmatrix} 5.346 \\ 14.03° \end{pmatrix}$

(e) Additive synthesis consist of generating sounds by adding together a number of pure tones. Describe how you would implement additive synthesis in Processing. [13]

Question 3

(a) What is a bit map? [3]

    a) The samples in an audio file

    b) An image represented as an array of pixels

    c) A terrain generation algorithm

    d) A computer vision technique

(b) What perceptual property of a sound corresponds to the amplitude of a sound wave? [3]

    a) loudness

    b) pitch

    c) frequency

    d) timbre

(c) What would you use a spring simulation for? [3]

    a) Animating stretchy cloth

    b) Animating a bouncing ball

    c) Animating an explosion

    d) Simulating air resistance

(d) What is the result of the following matrix multiplication? [3]

$$\begin{bmatrix} 4,1 \\ 1,3 \end{bmatrix} \begin{bmatrix} 3 \\ 4 \end{bmatrix}$$

    a) $\begin{bmatrix} 7 \\ 13 \end{bmatrix}$

    b) $\begin{bmatrix} 13 \\ 13 \end{bmatrix}$

    c) $\begin{bmatrix} 12 \\ 3 \end{bmatrix}$

    d) $\begin{bmatrix} 17 \\ 16 \end{bmatrix}$

(e) How would you implement an automatic terrain generation system for a 3D game? [13]

Question 4

  (a) What, in terms of an audio file, is bit depth?   [3]

       a) how many samples it contains a second

       b) the size of each sample

       c) how far away the sound is

       d) how loud each sample can be

  (b) What is the formula for the distance between point $(x1, y1)$ and $(x2, y2)$ [3]

       a) $\sqrt{(x1 - x2) + (y1 - y2)}$
       b) $\sqrt{(x1 - x2)^2 + (y1 - y2)^2}$
       c) $(\sqrt{(x1 - x2)} + \sqrt{(y1 - y2)})^2$
       d) $\sqrt{((x1 + x2) - (y1 + y2)}$

  (c) What would you use texture mapping for?   [3]

       a) Improving the sound of a vocal performance

       b) Drawing a circle

       c) Adding the appearance of skin to a 3D character

       d) Blurring an image

  (d) What is matrix for a 3D rotation of $30°$ about the z axis   [3]

       a) $\begin{bmatrix} 0.866, & 0, & 0, & 0 \\ 0, & 0.866, & 0, & 0 \\ 0, & 0, & 0.866, & 0 \\ 0, & 0, & 0, & 1 \end{bmatrix}$

       b) $\begin{bmatrix} 1, & 0, & 0, & 0 \\ 0, & 0.866, & 0.5, & 0 \\ 0, & -0.5, & 0.866, & 0 \\ 0, & 0, & 0, & 1 \end{bmatrix}$

       c) $\begin{bmatrix} 1, & 0, & 0, & 0 \\ 0, & 0, & 1, & 0 \\ 0, & 1, & 0, & 0 \\ 0, & 0, & 0, & 1 \end{bmatrix}$

       d) $\begin{bmatrix} 0.866, & 0.5, & 0, & 0 \\ -0.5, & 0.866, & 0, & 0 \\ 0, & 0, & 1, & 0 \\ 0, & 0, & 0, & 1 \end{bmatrix}$

  (e) You are writing a tablet based DJ app in which users can scratch records by dragging with their fingers. How would you implement it so that the record turns properly as the users move their fingers   [13]

Question 5

(a) What does an analogue to digital converter do? [3]

    a) Converts an audio signal into numbers for manipulation on a computer

    b) Converts between bitmap and vector images

    c) Makes an audio file sound clearer

    d) Converts mouse input into pixels

(b) What is $P(X|Y)$? [3]

    a) the probability of X happening

    b) the probability of Y happening

    c) the probability of X and Y happening

    d) he probability of X given Y

(c) What would you use to blur an image? [3]

    a) A high pass filter

    b) A convolution kernel

    c) A homogeneous matrix

    d) A high bit depth

(d) What is the component of vector $\begin{bmatrix} 3 \\ 2 \end{bmatrix}$ in the direction of $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$? [3]

    a) $\begin{bmatrix} 2 \\ 3 \end{bmatrix}$

    b) $\begin{bmatrix} 3 \\ 4 \end{bmatrix}$

    c) $\begin{bmatrix} 1.3416 \\ 1.7888 \end{bmatrix}$

    d) $\begin{bmatrix} 2.6832 \\ 0.8944 \end{bmatrix}$

(e) The correct way to do bouncing when two circles collide is for the speeds of the circles parallel to the collision to be reversed and for the speeds at right angles to the collision to stay the same. How would you implement this? [13]