UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

B. Sc. Examination 2015

Computing

IS51016A   Audio-Visual Computing, Audio-Visual Information Systems, Creative Audio-Visual Computing

Duration: 2 hours 15 minutes

Date and time:

There are five questions in this paper. You should answer THREE of them. Each question is marked out of 25. The marks available 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.

There are 75 marks available on this paper.

THIS PAPER MUST NOT BE REMOVED
FROM THE EXAMINATION ROOM

Question 1

(a) For which of the following would you use a high-pass filter? Select all that apply. [3]

    a) Manipulating the pixels in a dark image

    b) Adding low frequency sounds to a sample

    c) Reducing the brightness of an image

    d) Reducing rumbles in an audio recording

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

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

    b) img.pixels[i] = color(1.5*r, 1.5*g, 1.5*b);

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

    d) img.pixels[i] = color(r*0.2, g*0.2, b*0.2);

    e) None of the above

(c) Which of the following could be represented fairly well using sine waves? Select all that apply. [3]

    a) A pure musical tone

    b) Waves on a pool of water

    c) A rough texture

    d) Slowly undulating hills

    e) None of the above

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

    a) float angle = cos(shipPos.x - portPos.x, shipPos.y - portPos.y);

    b) float angle = atan2(portPos.y- shipPos.y, portPos.x - shipPos.x);

    c) float angle = acos(portPos.x - shipPos.x, portPos.y - shipPos.y);

    d) float angle = atan2(shipPos, portPos);

(e) You are applying to a job with a New Media company and have been asked to an interview. They are hoping to create a mobile photography application to compete with Instagram. Describe how you would implement an image effect (or effects) that would really impress them. You answer should focus on the image processing and not on the user interaction with the system. Use pseudocode to illustrate your idea. [13]

Question 2

(a) Which tasks below would be most easily done using vectors? Select all that apply. [3]

    a) Changing the pixel values in an image

    c) Pointing one object at another

    b) Determining the distance between two objects

    d) Altering the perimeter of a shape

(b) Which of the following *Processing* commands would you use when drawing a complex, irregular polygon? Select all that apply. [3]

    a) endShape()

    b) PImage

    c) filter()

    d) vertex

    e) None of the above

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

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

    b) vel.mult(-0.465);

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

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

(d) What would you use a spring simulation for? Select all that apply. [3]

    a) Modeling an explosion

    b) Animating stretchy fabric

    c) Animating a bouncing ball

    d) Simulating hair

(e) You have been asked to implement an app in which users can select a piece of an image by tracing around its outline. Once they have done this, the rest of the image disappears and they can apply several filter effects to the selected area. Describe how you would implement this. Use pseudocode to illustrate your idea. [13]

Question 3

(a) What do the cartesian co-ordinates (x,y) of a 2D point directly represent? Select all that apply. [3]

    a) The horizontal and vertical distances from the origin

    b) The angle and distance from the origin

    c) Its brightness and colour

    d) Its size and shape

(b) Which of the following would be most likely to increase the size of an audio file? Select all that apply. [3]

    a) Applying a 1-second delay effect

    b) Increasing the sample rate from 22kHz to 128 kHz

    c) Changing the bit depth from 16 bit to 8 bit

    d) Applying a high-pass filter

(c) In the following equation, what is the phase of the sine wave: a, b, c, or d: [3]

$$f(t) = a\sin(bt + c) + d$$

(d) Which of these would be best achieved using perlin noise? Select all that apply. [3]

    a) Simulating a landscape in a game

    b) Generating a pure audio tone

    c) Simulating planetary orbits in a solar system

    d) Generating an echo effect in an audio file

(e) You have been asked to implement software to assist with sorting apples on an assembly line. The software will use a webcam attached to a computer running Processing. The camera is to be pointed at the assembly line and a single row of apples will pass by its field of view. The app will look for bad apples and will play a warning sound when a bad apple is detected. Good apples are red and bad apples are any other colour. Describe how you would implement this. Use pseudocode to illustrate your idea. [13]

Question 4

  (a) Which of the following are used to used to perform a gaussian blur? Select all that apply.   [3]

      a) A high pass filter

      b) A neighbourhood filter

      c) A homogeneous matrix

      d) A high bit depth

  (b) Which of the following is most suitable for audio control over IP networks?   [3]

      a) Analogue to Digital conversion protocol

      b) Open Sound Control (OSC) protocol

      c) Serial communications protocol

      d) Musical Instrument Digital Interface (MIDI) protocol

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

$$\begin{bmatrix} 3,2 \\ 2,1 \end{bmatrix} \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

      a) $\begin{bmatrix} 7 \\ 4 \end{bmatrix}$

      b) $\begin{bmatrix} 8 \\ 5 \end{bmatrix}$

      c) $\begin{bmatrix} 4 \\ 1 \end{bmatrix}$

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

  (d) What is the probability of throwing the sequence, head, tail, head, in three coin tosses?   [3]

      a) $\frac{1}{6}$

      b) $\frac{1}{2}$

      c) $\frac{3}{4}$

      d) $\frac{1}{8}$

  (e) You have been hired to work on a new, ground-breaking 3D game. The game takes place in realistic environments and natural settings. Describe how you would implement an automatic terrain generation system that would provide detailed and impressive natural features. Use pseudocode to illustrate your solution.   [13]

Question 5

(a) What is the vector between $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 3 \\ 7 \end{pmatrix}$ [3]

    a) $\begin{pmatrix} 5 \\ 6 \end{pmatrix}$

    b) $\begin{pmatrix} 1 \\ 5 \end{pmatrix}$

    c) $\begin{pmatrix} 1 \\ 6 \end{pmatrix}$

    d) $\begin{pmatrix} 5 \\ 7 \end{pmatrix}$

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

    a) Loudness

    b) Phase

    c) Timbre

    d) Pitch

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

    a) Samples an audio input for manipulation on a computer

    b) Downsamples an audio file

    c) Converts between bitmap and vector images

    d) Performs a fast Fourier Transform analysing a waveform

(d) Which of the following are characteristics of vector graphics? [3]

    a) They sometimes exhibit aliasing artefacts

    b) They can scale infinitely with no loss of precision

    c) They compactly represent photographic quality images

    d) Bitmaps can be applied to their surfaces using texture mapping

(e) Describe how you would write a *Processing* program that plays back a music file and manipulates it so that it sounds like it is being played in a different environment, for example a stadium or inside a tunnel. You are encouraged to think of other kinds of environments than just these. Use pseudocode to illustrate your solution. [13]