THIS PAPER IS NOT TO BE REMOVED FROM THE EXAMINATION HALL

UNIVERSITY OF LONDON

CO3346 ZB

BSc EXAMINATION

Creative Computing

Sound and music

Wednesday 8 May 2019: 14.30 – 16.45

Time allowed: 2 hours and 15 minutes

DO NOT TURN OVER UNTIL TOLD TO BEGIN

There are FOUR questions in this paper. Candidates should answer **THREE** questions. All questions carry equal marks, and full marks can be obtained for complete answers to a total of **THREE** questions. The marks for each part of a question are indicated at the end of the part in [.] brackets.

Only your first **THREE** answers, in the order that they appear in your answer book, will be marked.

There are 75 marks available on this paper.

A handheld calculator may be used when answering questions on this paper but it must not be pre-programmed or able to display graphics text or algebraic equations. The make and type of machine must be stated clearly on the front cover of the answer book.

Question 1 Computational models of music cognition

(a) What is cognitive science? What is the role of computational modelling in cognitive science? [3]

(b) Name and describe **TWO** application areas for computational models which relate to musical cognition. [4]

(c) Music can be represented as a sequence of notes or as an audio recording. Describe the characteristics of these two representations and name file formats that could be used to store them in a computer.

[4]

(d) You have some music represented as a sequence of notes. Name **TWO** analyses that you can do if you are able to group the notes somehow. [2]

(e) Name the set of principles that can be used to group information. Name **TWO** principles and how they can be used to support the two tasks you named in the previous answer.

[4]

(f) In science, it is common to create models that allow us to make predictions about events or phenomena in the real world. Provide an example of a musical model that can predict something, stating what it aims to predict.

[2]

(g) Explain how an n-gram model can be built out of a sequence of musical notes. Write out examples of the n-grams. [3]

(h) Name a key-finding algorithm. What are its inputs and outputs? Does it use an n-gram model? [3]

Question 2 Computer Music and Pure Data

(a) The Pure Data environment can be described as a kind of integrated development environment (IDE). During your studies you will have used other IDEs to develop text based languages. Describe **THREE** ways in which the Pure Data IDE and a text language IDE differ. [9]

(b) Write step by step instructions explaining how to build a Pure Data patch that loads and plays back an audio file. Draw diagrams to illustrate your steps, showing how the patch is built. There should be at least **FIVE** steps. [10]

(c) What is synthesized sound? How is it different from sampled sound? [2]

(d) Draw a Pure Data patch which implements sound synthesis, using at least two audio generators or processors, including some GUI controls. Annotate the patch, explaining how it works. [4]

Question 3 Algorithmic Composition

(a) A composer rolls two six-sided dice and uses the sequence of numbers, which are in the range 2-12, to select notes for a melody. Is this algorithmic composition or normal composition? Why? [3]

(b) Name a composer who has used algorithmic composition. [1]

(c) Name and briefly describe a non-random technique that can be used for algorithmic composition. [2]

(d) Name a computer music performance technique that involves writing code in front of an audience, where the audience can see the code for a musical algorithm being written by the performer. [1]

(e) Why do you think people use the technique you mentioned above to perform music? Give **TWO** reasons. [2]

(f) Live algorithms are discussed in the subject guide. They are musical algorithms that can improvise music along with a human performer. Name and describe the **FOUR** desirable characteristics of these systems. [8]

(g) Consider a jazz saxophone player improvising with a human band. For each of the desirable characteristics of a live algorithm you mentioned above, state if the saxophonist has these characteristics. [4]

(h) Explain the key elements of a live algorithm based on a swarm model. [4]

Question 4 Music Information Retrieval

(a) Name a music information retrieval task that has high specificity and one that has low specificity. [2]

(b) Explain how a recommender system works. What is the input? What is the output? How is the data structured? Draw a diagram if that helps your explanation. [6]

(c) Cepstrum coefficients describe the timbre of the music they are extracted from. Do you think that timbre is an appropriate feature to build a recommender system upon? Justify your answer. [2]

(d) Name the two main types of data that are used in music information retrieval. [2]

(e) Which type of data would be more appropriate for use in a system which aims to automatically assign a genre to pieces of music? Why did you choose that type of data and why did you not choose the other one? [4]

(f) Consider a music recommender system. Given the three inputs below, state how a recommender system might generate a list of recommendations. What kind of data would it need to achieve this? What kind of results might it provide?

i. The user has been listening to Mozart's compositions. [3]

ii. The user has been searching for acoustic guitars on the Amazon online store. [3]

iii. The user has only just signed up for the service, so there is no information about them. [3]

END OF PAPER