UNIVERSITY OF EDINBURGH

COLLEGE OF SCIENCE AND ENGINEERING

SCHOOL OF INFORMATICS

MUSIC INFORMATICS

Wednesday 1$\underline{\text{st}}$ April 2009

00:00 to 00:00

MSc Courses

INSTRUCTIONS TO CANDIDATES

Answer QUESTION 1 and ONE other question.

Question 1 is COMPULSORY.

All questions carry equal weight.

CALCULATORS MAY NOT BE USED IN THIS EXAMINATION

This question is compulsory

1. (a) Describe briefly a method to use note onset interval information to estimate local tempo of music based on an underlying metrical pulse. *[3 marks]*

   (b) What is meant by a "metrical hierarchy" when analysing music in the mainstream western tradition? *[3 marks]*

   (c) Explain what the task of automated *score following* involves, and describe briefly one approach to making this robust in the context of live performance. *[3 marks]*

   (d) How does the two-dimensional array organised by perfect fifths and major thirds enable transcription from MIDI pitches top conventional score pitch notation for tonal music? *[4 marks]*

   (e) Give one of Lerdahl and Jackendoff's rules for determining breaks between musical segments, and illustrate with an example where the rule applies. *[3 marks]*

   (f) David Cope made use of a collection of *signatures* of a number of musical pieces when generating music in a particular style. Explain what signatures are, and how they are recognised automatically. *[4 marks]*

   (g) Suppose we listen to a melody in traditional western style. Describe the components of a symbolic representation for the pitch and temporal aspects of the music, and explain how an entropy calculation can be used to compare different possible representations of the same music. *[5 marks]*

2. (a) What is a *pitch-class set* in the theory of atonal music? [*4 marks*]

    (b) Sketch an algorithm to determine when two collections of pitches are instances of the same pitch-class set. [*5 marks*]

    (c) A paradigmatic analysis of atonal melodies can be carried out by dividing the pitches into disjoint classes, each formed from successive pitches from the given melody, and matching up repetitions of pitch-class sets. Sketch an algorithm to carry out such an analysis which aims to maximise the size to repeated pitch-class sets. [*5 marks*]

    (d) The usual pitch-class set theory is based on a division of the octave in 12 equal intervals. Suggest how the theory could be adapted to a division of the octave by smaller intervals, say 24 equal intervals. Estimate how this would affect the number of distinct pitch-class sets. [*5 marks*]

    (e) Lerdahl and Jackendoff's Generative Theory of Tonal Music aims to describe music structured around the notion of key.

    Discuss which aspects of their theory can be expected to apply also to atonal music, and which aspects will not apply to atonal music. Justify your answer; you may want to take some particular form of atonal music as an example. [*6 marks*]

3. (a) Consider the musical task of providing a 4-part harmonisation of a given melody. Distinguish between the *declarative* and *procedural* aspects of the knowledge of someone who is an expert in carrying out this task. *[3 marks]*

   (b) What are the main components of a *rule-based system* (Knowledge-Based System) designed to carry out this task? Indicate what work the designer of such a system needs to do, bearing in mind that both declarative and procedural aspects are involved. *[4 marks]*

   (c) Describe how a Hidden Markov Model could be produced to help with the task of providing the outline harmonic progressions for this task, given a set of harmonised melodies. *[4 marks]*

   (d) Experience suggests that some aspects of the harmonisation task are better dealt with by the rule-based approach, and others via machine learning. Suggest some possible reasons why this might be the case. *[4 marks]*

   (e) Discuss the issues involved in integrating virtual musicians with human performers in musical improvisation. What do you think are the main problems in achieving realistic musical interaction in these circumstances? How might these problems be addressed? *[10 marks]*