Instructions

Please write your name and student number on all answer sheets.

This exam is closed book with a duration of 1h15.

Partial credit is possible, so give each question a try.

Show all your work and reasoning. This is the only way to be able to give partial credit to your answers.

If you get stuck in a question, leave it for later and go on to solve the others.

The use of communication devices (e.g., computer, smartphone, mobile phone, etc) during the exam is strictly forbidden.

Voluntary Code of Ethics

Please sign below if you agree to comply with the following sentence.

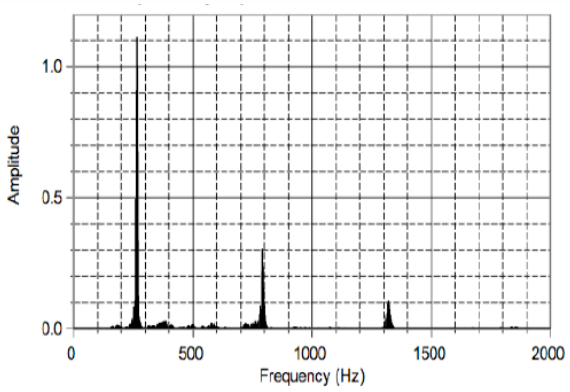
"I give my word of honour that I shall not use any unauthorised means to answer this exam."

Student's signature: _____

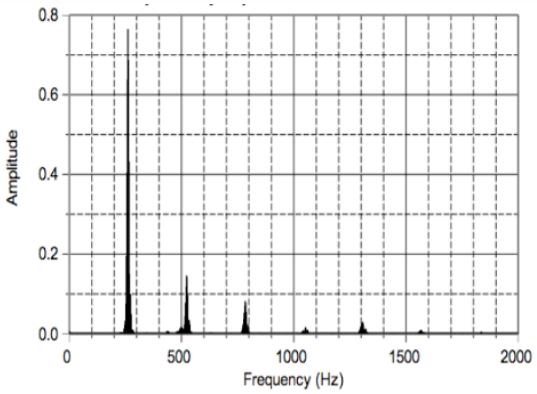
Good work!

Group I [14 points] - Questions related to the topics addressed in the laboratory classes.

1. **[1 point]** The frequency spectra for two wind musical instruments *wind1* and *wind2* playing the note C4 are shown in the following figures. By definition, a closed-end blowing instrument shows prominent odd (1,3,5,…) harmonics, whereas an open-end shows all (1,2,3,…) harmonics. Which of these instruments (a or b) is an open-end wind instrument?



a)



b)

2. **[3 points]** Indicate two objective and two subjective characteristics of sound. Explain briefly one of each type.

3. **[4 points]** Imagine that we have a repetitive rhythm produced by a sound source in which a note is played at every beat.

    3.1. **[1 point]** How many beats would exist for a short snippet with 10 onsets?

    3.2. **[1 point]** For the same short snippet, how often (i.e. how many times) would the novelty function exhibit a peak? (The novelty function detects a strong increase or decrease in the RMS energy, which corresponds to a sharp signal alteration).

    3.3. **[2 points]** At how many beats-per-minute (bpm) would we start hearing this sound as a pitched signal?

4. **[4 points]** In a task of beat tracking, the algorithm outputs the following estimation (in secs): `estimated_beats = [0.5, 0.821, 1.21, 1.45, 1.69, 1.8, 2.1]`, whereas the human-annotated ground-truth is given by (in secs): `annotated_beats = [0.5, 0.8, 1.3, 1.42, 1.67, 1.8, 2.05, 2.11]`.

    4.1. **[1 point]** Given a tolerance window of 0.05 seconds, how many **correct** beats are there?

    4.2. **[1 point]** Given a tolerance window of 0.01 seconds, how many **incorrect** beats are there?

4.3. **[2 points]** If we define $precision = \frac{TP}{TP \quad P}$, where TP correspond to true positives and P correspond to false positives, what would be this evaluation score for 4.1 and 4.2?

5. **[2 points]** In the context of multimedia applications, imagine the following tasks: **Task1**) classify a given animal image as belonging to one of three groups of animals (cats, dogs, parrots); **Task2**) convert from WAV to MP3 to be listened to through mobile devices;

   5.1. **[1 point]** Briefly explain the type of evaluation (objective and/or subjective) you would use for each task.

   5.2. **[1 point]** What type of approach (Traditional Approach vs Machine Learning Approach) is best suited for each task? Explain briefly.

Group II [6 points] - Questions related to the topics addressed in the theoretical classes.

6. **[1 point]** Explain briefly what is "cognitive friction" and how it can be avoided or minimised.

7. **[1 point]** Describe the benefits of developing storyboards when prototyping mm applications.

8. **[1 points]** When errors or losses occur in video streaming, is the negative impact on the perceptual quality likely to be the same regardless of the type of algorithm used for compressing video? For instance, all intra versus predictive video encoding schemes. Justify your reply.

9. **[2 points]** HAS defined a new paradigm to address bandwidth congestion variability in relation to traditional steaming. Please describe this new paradigm.

10. **[1 point]** Explain briefly the solution implemented in the HAS protocols to minimise latency in live streaming.

END