**Applied Acoustics - 14/12/2021 In-class test - Lecturer: Angelo Farina**

Note: some input data are based on the 6 digits of Matricula number, assigned to the 6 letters A B C D E F.

If you do not have yet a matricula number use your date of birth: DDMMYY.

If for example the matricula is 123456, it means that A=1, B=2, C=3, etc. .

Furthermore CD=34 (NOT 3x4), DE =45, EF =56.

Top of Form

**Surname and Name**

F

E

D

C

B

A

**Matricula**

1. **Check the sentences you think are always TRUE**  (multiple answers allowed)

* IIR filters are always preferable to FIR filters, as IIR is more efficient computationally
* The design of IIR filters is tricky and difficult, as they can be unstable
* The design of FIR filters is simple, and they are always stable
* A modern processor can use FIR filters up to a few thousands taps
* A modern processor can use FIR filters of any length (even millions of taps)
* Aliasing occurs when an analog-to-digital converter is operated with a limited resolution (less than 24 bits)

1. **An Ambisonics multichannel audio track can be:**  (multiple answers allowed)

* recorded using a compact microphone array
* synthesized from a number of mono tracks, spatially panned in different locations
* reproduced over headphones by convolving with a proper binaural filter matrix
* reproduced over a loudspeaker rig, employing a proper decoder
* converted to any other "coincident" stereo recording, such as XY or MS
* converted to any closely-spaced stereo recording, such as ORTF or INA
* employed for feeding a Dolby Digital Surround system (5.1)

1. **What is "spatial aliasing" ?** (a single answer)

* It is the appearance of spurious peaks when the signal contains frequencies above the Nyquist frequency (half of the sampling frequency)
* It is the appearance of the last part of an impulse response before the arrival of the direct sound, being folded back at the beginning when the IR was cut too short
* It is the distortion of the spatial information occurring when the signal contains frequencies too large in comparison of the spacing between the microphones constituting a microphone array
* It is the distortion of the spatial information occurring when the signal contains frequencies too large in comparison of the spacing between the loudspeakers in a WFS array
* It is the disruption of the signal integrity caused by jitter on the sampling clock
* It is the distortion of the waveform caused by using a converter with a limited resolution (number of bits)

1. **On ORTF stereo microphone pair is recording a sound source located at an azimuth of 30+2\*F degrees from front. Compute the inter-channel time delay.**(write number and measurement unit)
2. **An Ambisonics microphone is recording a sound source located at an azimuth of 30+2\*F degrees from front. Compute the level difference between channels X and Y.**(write number and measurement unit)

1. **A microphone is placed 20+E cm in front of a reflecting wall. The sound is impinging on the microphone perpendicularly to the wall surface, and bounces back to the microphone, causing a nasty comb filtering effect. Compute the frequency of the first notch.**   
   (write number and measurement unit)

<<< FOLLOWS ON BACK >>>

1. **The sound system of a car has two speakers, and must be optimized for the driver. The distances of the two loudspeakers from the center of the driver's head are: rleft = 0.4+F/20 m, rright = 0.8 +E/25 m. Compute the delay to be applied to the left channel for aligning temporally the two signals.**(write number and measurement unit)

1. **In the same case as the previous exercise, compute the gain reduction to be applied to the left channel for aligning the amplitude of the two direct-sound signals.**

(write number and measurement unit)