Lecture 12, Question 1

- Define an algebraic Signal processing model.

- Discuss how graph signal processing follows as a particular case.

Lecture 12, Question 2

- Define the concept of generator of an algebra
- Define the concept of shift operator.
- These two definitions give rise to polynomials that represent filters and their instantiations. Explain their similarities and differences
- Coordinate your response with the response to Question 3

Lecture 12, Question 3

- The three fundamental concepts of an algebraic signal model are three polynomials. Define them and explain their different meanings.

- Coordinate your response with the response to Question 2

- Explain how graph signal processing, discrete time signal processing, and image processing follow as particular cases of algebraic signal processing models.

- An algebraic neural network is made up of layers. Each of which composes algebraic filters, pointwise nonlinearities and pooling operators. Explain/

- The perturbation of algebraic signal processing models entails the perturbation of their shift operators. Explain.

- Of all the pieces of the model that could be perturbed, this is the one whose perturbation is justified by practice. Explain.

- State a theorem claiming the stability of algebraic filters to deformations of the shift operators.

- State a theorem claiming the stability of algebraic neural networks to deformations of the shift operators. There are several you can state here. Write down the one you find most illuminating.

- The introduction of these theorems requires that you introduce some preliminary definitions. Do not dwell unnecessarily on them. We already know what Lipschitz and integral Lipschitz filters are. We don't really know much of Frechet derivatives and commutativity factors.

- Your classmate has just explained stability theorems for algebraic filters and algebraic neural networks. Explain the implications of this theorems for graph filters and GNNs.

- Explain the implications of the theorem for Convolutional neural networks in one and two dimensions.