Simulation Exercise #04: Discrete Systems

INF301 – Systems Modeling and Simulation – W04

Prof. Luiz Henrique Bonani do Nascimento

Universidade Federal do ABC

Report Guidelines

Use a notebook on the Google Collaboratory platform to generate a report containing any explanations and comments you deem relevant, along with your codes and figures.

The graphs in the figures should be self-explanatory, with axis names and data captions. Use a font size appropriate for presentation in a document.

The language to be used is Python. However, the use of pre-built Python libraries is not permitted, except for those used in the examples.

Submit a single notebook file in ipynb format, with the file name in the format SE0N_NameSurname.ipynb, where N is the SE number, Name is your first name, and Surname is your last name.

Remember that plagiarism will not be tolerated under any circumstances!

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Problem 1 (50 points)

Consider the following data and the third-order Lagrange function.

t	$x(t)$
1.0	4
2.5	6
3.0	3
4.5	1
6.0	2

a) Find, mathematically, each of the constituent polynomials;

b) Find, mathematically, the Lagrange polynomial;

c) Compare the polynomials found with the results obtained using the Lagrange function.

d) Using the polynomial found, extrapolate an estimate of the function for t = 7. Analyze all the results found e provide the proper comments.

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Problem 2 (50 points)

Consider the continuous signal $x(t) = 2\cos(5t) + 7\sin(10t)$, which is sampled at a frequency of 20 samples per second. Assuming a granularity of $h = 0.01$ seconds:

a) Write a routine to extrapolate the signal with zero order holder.

b) Show the graph of the original signal and its zero-order approximation.

c) Show the graph of the original signal and its second-order approximation.

d) Analyze the results and provide the proper comments.

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