Concordia University
Department of Electrical & Computer Engineering
ELEC 342 – Discrete Time Signals and Systems
Thursday May 26, 2016
Dr. W. Lynch

Students are allowed two 8.5*11 inch formula sheet. Anything may be written on this sheet. Non programmable calculators, pens, pencils and straightedges are also allowed.

If you have a difficulty you may try making REASONABLE assumptions. State the assumption and how that assumption limits your answer. Show all your work and justify all your answers. Marks are given for how an answer is arrived at not just the answer itself.

1. Consider the following system

$$y[k] = T\{x[k]\} = x^2(-k+1) + k$$

Here the input is x[k] and the output is y[k].
For each of the following properties state whether the property is true or not. If it is true provide a general proof that the property is true. If the system doesn't have that property provide a very specific counter example.
   a) Time Invariance **(3 marks)**
   b) Stable. **(3 marks)**
   c) Causal. **(3 marks)**

2. Consider an LTI system with impulse response h[k] given as

$$h[k] = u[k] - u[k-5]$$

   a) Is this system stable? Justify your response. **(2 marks)**
   b) Is this system causal? Justify your response. **(2 marks)**
   c) Is this system memoryless? Justify your response. **(2 marks)**
   If the input to this system is

$$x[k] = 2^k u[k]$$

   You would like to get the output y[k].

   d) Should you do this using the Fourier Transform or with time convolution? **(1 mark)**
   e) I hope you said time convolution to the question above. Provide reasons why the Fourier Transform is a bad idea for finding y[k] **(2 marks)**
   f) Find y[k] using tie convolution. **(4 marks)**

3. Define

$$x[k] = \delta[k] + 2\delta[k]$$

Form

$$y[k] = \sum_{m=-\infty}^{\infty} x[k+5m]$$

   a) Draw a picture of y[k]. You should plot at least from k=0 to k=15. **(1 marks)**
   b) You probably noticed that y[k] is periodic. What is its period? **(1 marks)**
   c) Find the Fourier series coefficients for y[k]. **(4 marks)**

4. For an LTI system we give it the input

$$x[k] = (0.3)^k u[k] + (0.4)^k u[k]$$

This resulted in the output

$$y[k] = -6(0.3)^k u[k] + 8(0.4)^k u[k]$$

Find the impulse response h[k] of the system. **(5 marks)**