Name:

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| --- | --- | --- |
| Problem | Points | Score |
| 1(a) | 25 |  |
| 1(b) | 10 |  |
| 2(a) | 10 |  |
| 2(b) | 10 |  |
| 2(c) | 10 |  |
| 3(a) | 10 |  |
| 3(b) | 15 |  |
| 43c) | 10 |  |
| Total | 100 |  |

Notes:

1. The exam is closed books and notes except for four double-sided sheet of notes.
2. Please indicate clearly your answer to the problem.
3. If I can’t read or follow your solution, it is wrong and no partial credit will be awarded.

**Problem No. 1**: An LTI system is described by the difference equation:



(25) (a) Derive an expression for the frequency response. Sketch your result - be as specific as possible.

(10) (b) Derive an expression for the impulse response.

**Problem No. 2**: An 8-bit linear ADC has an input analog range of +/- 5V. The analog input signal is:



The converter supplies data at a rate of 2048 bits/sec.

(10) (a) What is the quantizer step size?

(10) (b) What is the SQNR in dB?

(10) (c) If the quantizer was an audio signal of the same range, how could you improve the performance of the ADC?

**Problem No. 3**: Compute and sketch the N-point DFT in the range of  for:

(10) (a) 

(15) (b) 

(10) (c) Explain the difference between the DFT of a sinewave when N is an integral number of periods, and when N is not an integral number of periods. Be a specific as possible and use sketches to demonstrate your points.