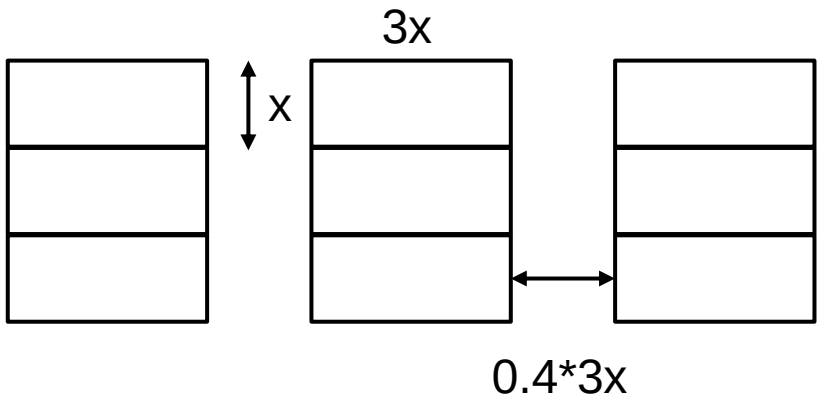
ELE 4142 HW5 Name_____

1) Assuming a 2Tb/in^2 areal density on a HDD platter, with a 3 to 1 width to length ratio of a bit and 40% spacing on each side(40% of the width) – calculate the length and width of a bit in nm. 15pts



let x = length
width of a bit is 3x
spacing = 2*((0.4*(3x))*0.5) = 1.2x

area = x*(3x + 1.2x) = 4.2x^2

2^{41}b X 4.2x^2 = 1in^2
x = 329x10^{-9} in
= 8.35nm

L = 8.35nm
W = 25.07nm → 35.1nm w/space

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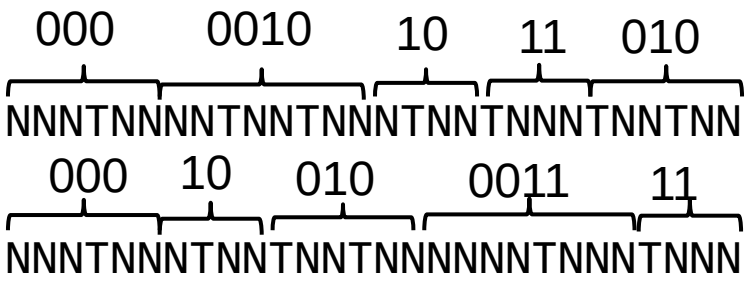
2) Your (2,7) RLL decoder generated the following data stream, provide the decoded bit stream in HEX 15 pts



0000 0101 0110 10

00 0100 1000 1111

0x056848F

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3a) Describe what Write-Wide, Read-Narrow means and why we would use it 5 pts

This refers to writing magnetic bits with a wide write head and reading with a narrow read head.

This allows for error in tracking and reduced noise when the read head is not near an outside edge of the write track

3b) Why do HDDs need to use RLL codes? 5 pts

To allow for clock recovery – if unlimited 1's or 0's are allowed clock recovery becomes impossible

3c) What mechanism prevents head slaps in normal rotating operation of a HDD

5 pts

The design of the mechanics creates a buffer of air which causes the head to fly over the disk – air bearing

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4) Calculate the best case and worst case read delay for the following DVD player 20 pts

	Units conversion
Sled radial speed – 1mm/ms	1mm/ms
Total sled read travel distance - 7.5cm	75mm
Disk rotation speed 5600 rpm	93.33rps
Radius at inside track – 0.4inches	10.16mm
Read channel delay (electronics) – 150us	150us

Worst case revolution

5600 rev/min x 1min/60 sec = 93.33 rev/sec

Time to 1 rev = 10.71ms

Worst case travel

75mm / 1mm/ms = 75ms

Read delay = 10.71 + 75 + 0.15 = 85.86ms

Best case revolution

0 ms

Best case travel

0 ms

Read delay = 0 +0 + 0.15 = 0.15ms

150us

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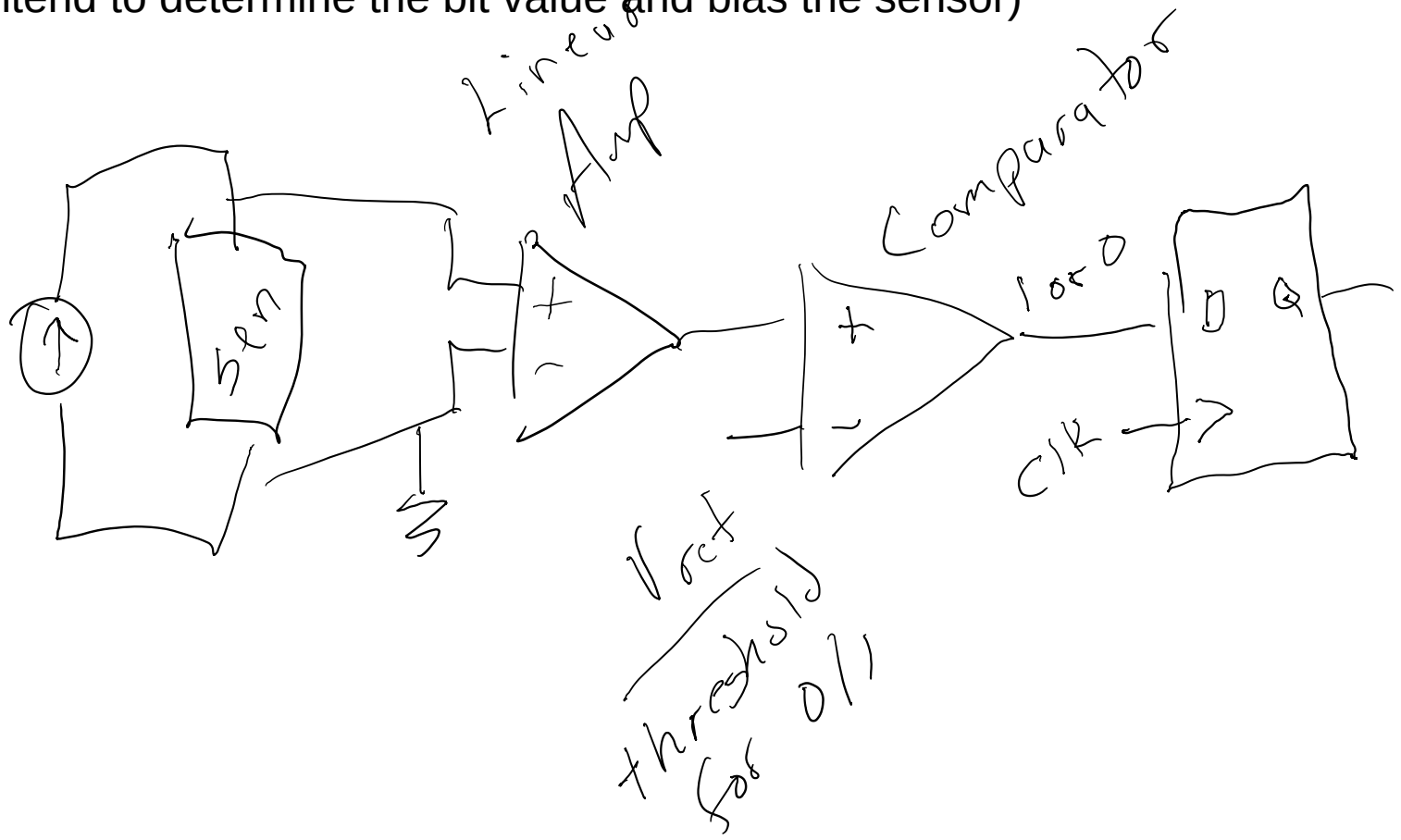
5) Search and Think 25 pts

Propose a circuit to measure the output of a GMR HDD sensor
Keep it simple – (if you use a Wheatstone Bridge you must document how you intend to determine the bit value and bias the sensor)



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6) Search and Think 10pts

Provide a short description of HAMR as it applies to Hard Disk Drives

HAMR drives work as the hard drive temporarily heats up the disk material, which makes it more receptive to the magnetic mechanisms at work inside the assembly. This makes it simpler to write data to smaller areas on the hard drive and increases data density per platter