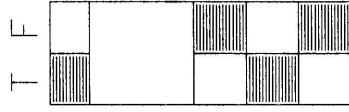



1. A thermistor is

- a) A semiconductor device.
- b) Has a resistance -vs- temperature behaviour given by $\Delta R = k \Delta T$ where k is constant.
- c) Is a resistor.
- d) Is used to measure strain.



Answer by blackening the right rectangles. 

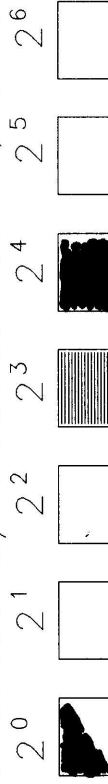
2. An 8-bit differential ADC with an input voltage range of $\pm 10\text{v}$ should be augmented with a differential input instrumentation amplifier of gain $\times 10^{-2}$ $\times 10^{-1}$ $\times 10^0$ $\times 10^1$ $\times 10^2$



(They are only available with

settings of $\times 10^{\pm n}$) in order to achieve maximum resolution when measuring a signal expected to vary between -30 and $+50\text{v}$?

3. What is the precision in counts/volt achieved in 2., above?



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4. Represent the number 57 in binary in the top 8-bit field, its one's complement in the next and its negative, two's complement, in the bottom one.

± 6 5 4 3 2 1 0



 = "one"

= "zero"

Answer by blackening the right rectangles. 

5. What is the shear modulus G of aluminum whose Young's modulus $E=0.70 \times 10^{11}$ Pa and whose Poisson's ratio is $\mu=0.33$?

Choose the closest value. 0.40×10^{11} Pa 0.35×10^{11} Pa 0.30×10^{11} Pa

0.25×10^{11} Pa 0.20×10^{11} Pa 0.15×10^{11} Pa

6. What is the peak-to-peak voltage of a 220v AC RMS domestic (sinusoidal) power supplied by Hydro-Québec? 120v 220v 320v 420v

520v 620v 720v

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7. The linearized first order temperature measuring system referred to on the included sheet of explanation is sitting at 20C and is plunged into boiling water at 100C, suddenly, at $t=0$.

The initial voltage output was 1.6mv. After a long time the output is 4.3mv. Find $k_0=k$ and specify the units.

80/2.7 2.7/80 120/5.9 5.9/120 -2.7/120 -80/2.7

v/C C/mv mv/C

8. The exercise above is repeated but this time a reading at $t=1.4s$ yields an output of 2.9mv. Find the time constant and coefficient c.

c= 4.918 6.213 8.043 5.675 k/c= 1.894 5.221 -2.227

Answer by blackening the right rectangles.

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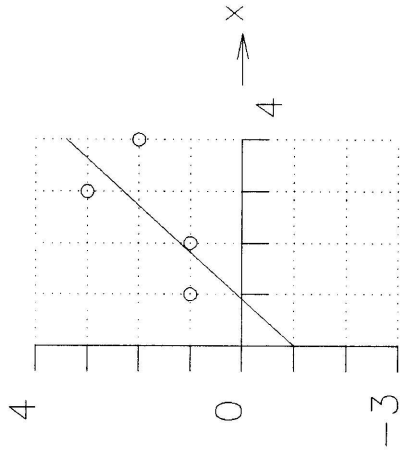
(circle one) MECH 261 262

STATISTICS

9. Given the 4 points (1,1),(2,1),(3,3),(4,2) do a best least squares sum fit minimizing the sum of Δx^2 . I.e., Find a' and b' and plot results below, neatly.

$a' =$ -10/11 10/11 -11/10 11/10

$b' =$ 1 2 3 -1 -2 -3



Answer by blackening the right rectangles and drawing a straight line.

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STATISTICS

10. Using the results from Question 9, compute the variance, v , and the standard deviation, σ , of Δy_i in $y = a'x + b'$. Use $n=4$ because we are referring these to the line which we now know. The first entry in the table below is done to make your job easy.

x_i	y'_i	y_i	Δy_i	Δy_i^2	$v =$	0.417	0.189	0.733	0.629
1	$1.1 - 1 = 0.1$	1	+0.9	0.81	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	$2.2 - 1 = 1.2$	1	-0.2	0.04	$\sigma = 0.718$	0.856	0.337	0.504	<input type="checkbox"/>
3	$3.3 - 1 = 2.2$	3	+0.8	0.64	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	$4.4 - 1 = 3.2$	2	-1.2	1.44					
				$\frac{2.93}{4}$					

Answer by blackening the right rectangle.

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 key
 Student Number: --
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STATISTICS 11. A lazy student attempts this test by randomly choosing to fill rectangles for all previous questions except Question 4 which requires multiple filling. All questions are of equal value so consider these nine questions, 1,2,3,5,6,7,8,9,10 will yield a perfect score of 10 each =90. What is his*expected score based on the law of large numbers?
 Falses are not deducted from Trues in T/F questions.
 If a question has 2 parts, each is worth 5 marks.
 Do not include this question.

<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	10	20	25	30	35	40
						50

Sorry about the lack of a 4th statistics question and for leaving out binomial, Poisson's distribution, rotten eggs, cancer and all that stuff. You'll see it on the final. I Think we've all had enough by now and somebody's gotta grade it.

* I don't think the ladies will mind my political incorrectness.

Answer by blackening the right rectangle.

Midterm Test 04-02-19, 120min. 262

Name:-- _____ key

Student Number:-- _____

(circle one) MECH 261 262

(28)MLS42kF