PHYSICS 110 LAB 5
ARFAZ HOSSAIN
V00984826

Analysis Worksheet

1. Include a photo of your data that shows your TAs signature.

No.	R (Ω)	No.	R (Ω)	No.	R (Ω)	No.	R (Ω)	No.	R (Ω)
1	104.1	11	98.2	21	98.6	31	98.5	41	98.6
2	98.4	12	104.2	22	100.2	32	104.5	42	101.1
3	102.2	13	101.6	23	99.0	33	102.4	43	100.5
4	102.9	14	103.4	24	95.2	34	100.8	44	100.4
5	100.6	15	100.0	25	101.6	35	98.2	45	103.5
6	100.7	16	102.0	26	100.4	36	105.2	46	102.8
7	102.4	17	102.3	27	99.2	37	102.3	47	101.6
8	102.3	18	98.1	28	98.4	38	98.1	48	100.1
9	99.1	19	98.7	29	103.3	39	97.8	49	101.3
10	100.3	20	100.3	30	98.9	40	100.7	50	103.7

Please Turn Over

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Arfaz Hossain (V00984826)

James Kim (V00993463)

	R(Ω)
1	104.1
2	98.4
3	102.2
4	102.9
5	100.6
6	100.7
7	102.4
8	102.3
9	99.1
10	100.3
11	98.2
12	104.2
13	101.6
14	103.4
15	100
16	102
17	102.3
18	98.1
19	98.7
20	100.3
21	98.6
22	100.2
23	99
24	95.2
25	101.6
26	100.4
27	99.2
28	98.4
29	103.3
30	98.9
31	98.5
32	104.5
33	102.4
34	100.8
35	98.2
36	105.2
37	102.3

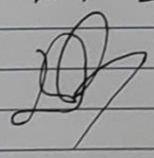
	R(Ω)
38	98.1
39	97.8
40	100.7
41	98.6
42	101.1
43	100.5
44	100.4
45	103.5
46	102.8
47	101.6
48	100.1
49	101.3
50	103.7

Blue B

Arfaz Hossain

James Kim

Mar. 25



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2. Calculate the mean and standard deviation of your set of resistors.

Mean is [(R1+R2+R3+ .... +R49+R50) / 50] = **100.774 Ω**
Standard Deviation, σ is **2.13921690802776 Ω**
[x = Ri; x(bar) = R(mean); N = 50]
[i = incremented values from 1 to 50]

$$\mathrm{SD} = \sqrt{\frac{\sum |x - \bar{x}|^2}{n}}$$

3. Include your table for your 8-segment histogram.

bar marks	i	R(i) Ω	R(i+1) Ω	R(mid) Ω	n(i)	P(i)	p(R(mid))	p(R(mid))ΔR
-2	1	96.49557	97.56517	97.0304	0	0.000	0.04033126	0.043138659
-1.5	2	97.56517	98.63478	98.1000	10	0.200	0.08538128	0.091324543
-1	3	98.63478	99.70439	99.1696	5	0.100	0.14076994	0.150568716
-0.5	4	99.70439	100.77400	100.2392	11	0.220	0.18075218	0.193334058
0	5	100.77400	101.84361	101.3088	6	0.120	0.18075218	0.193334058
0.5	6	101.84361	102.91322	102.3784	9	0.180	0.14076994	0.150568716
1	7	102.91322	103.98283	103.4480	4	0.080	0.08538128	0.091324543
1.5	8	103.98283	105.05243	104.5176	3	0.060	0.04033126	0.043138659
2								

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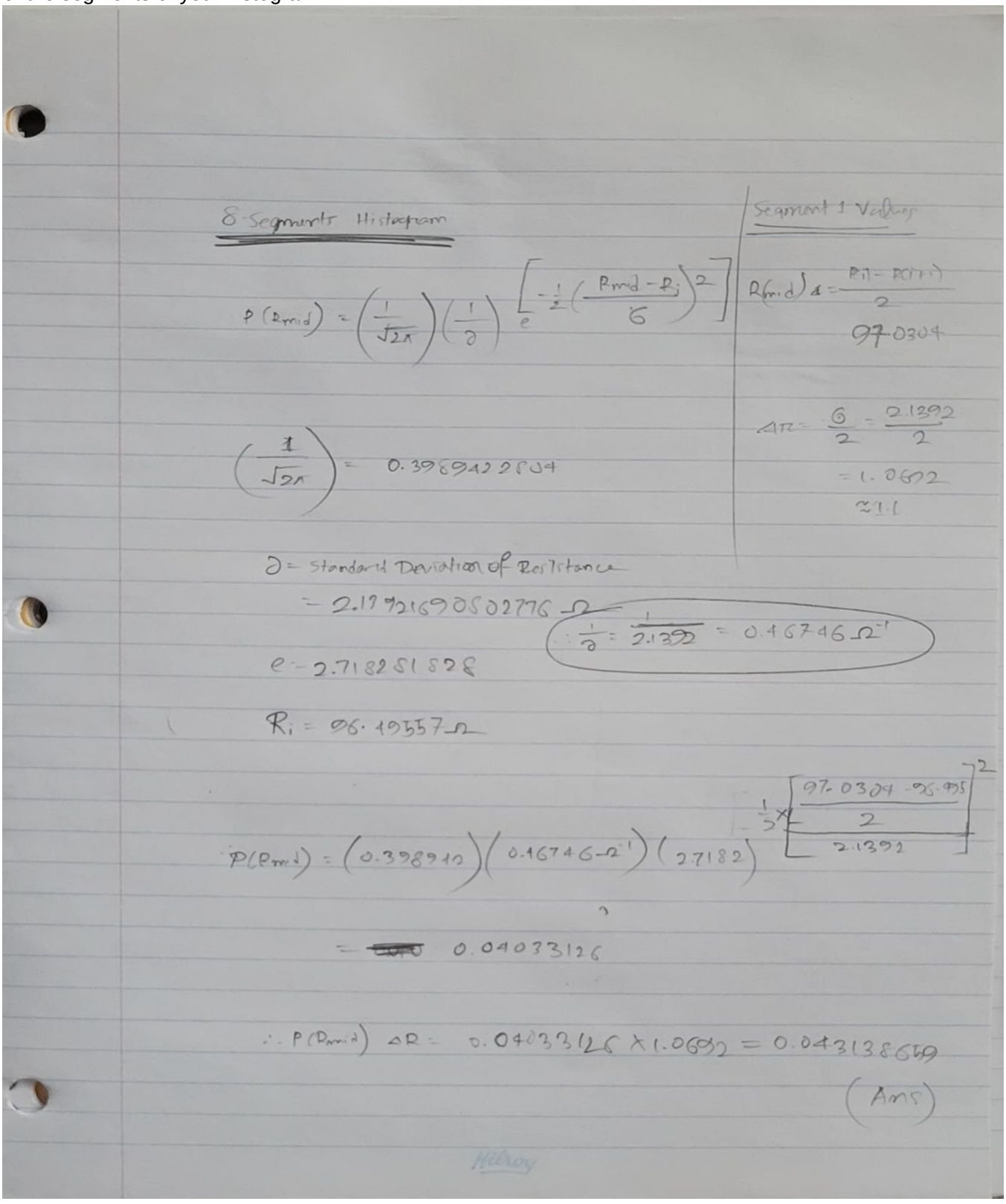
4. Show a sample calculation of how you calculated $p(R_{mid})\Delta R$, including all the values that you used, for one of the segments of your histogram.



8-Segments Histogram

$$P(R_{mid}) = \left(\frac{1}{\sqrt{2\pi}}\right)\left(\frac{1}{\sigma}\right) e^{\left[-\frac{1}{2}\left(\frac{R_{mid}-R_i}{\sigma}\right)^2\right]}$$

$\left(\frac{1}{\sqrt{2\pi}}\right) = 0.398942284$

σ = Standard Deviation of Resistance

$= 2.197216905027776\ \Omega$

$\therefore \frac{1}{\sigma} = \frac{1}{2.1392} = 0.467466\ \Omega^{-1}$

$e = 2.718281828$

$R_i = 95.19557\ \Omega$

Segment 1 Values

$R(mid)_1 = \frac{R_{i1} - R_{(i+1)}}{2}$

97.0304

$\Delta R = \frac{6}{2} = \frac{2.1392}{2}$

$= 1.0692$

≈ 1.1

$P(R_{mid}) = (0.398942)(0.467466\ \Omega^{-1})(2.7182)^{-\frac{1}{3}\left[\frac{97.0304 - 95.975}{2.1392}\right]^2}$

$= 0.04033126$

$\therefore P(R_{mid})\ \Delta R = 0.04033126 \times 1.0692 = 0.043138659$

(Ans)

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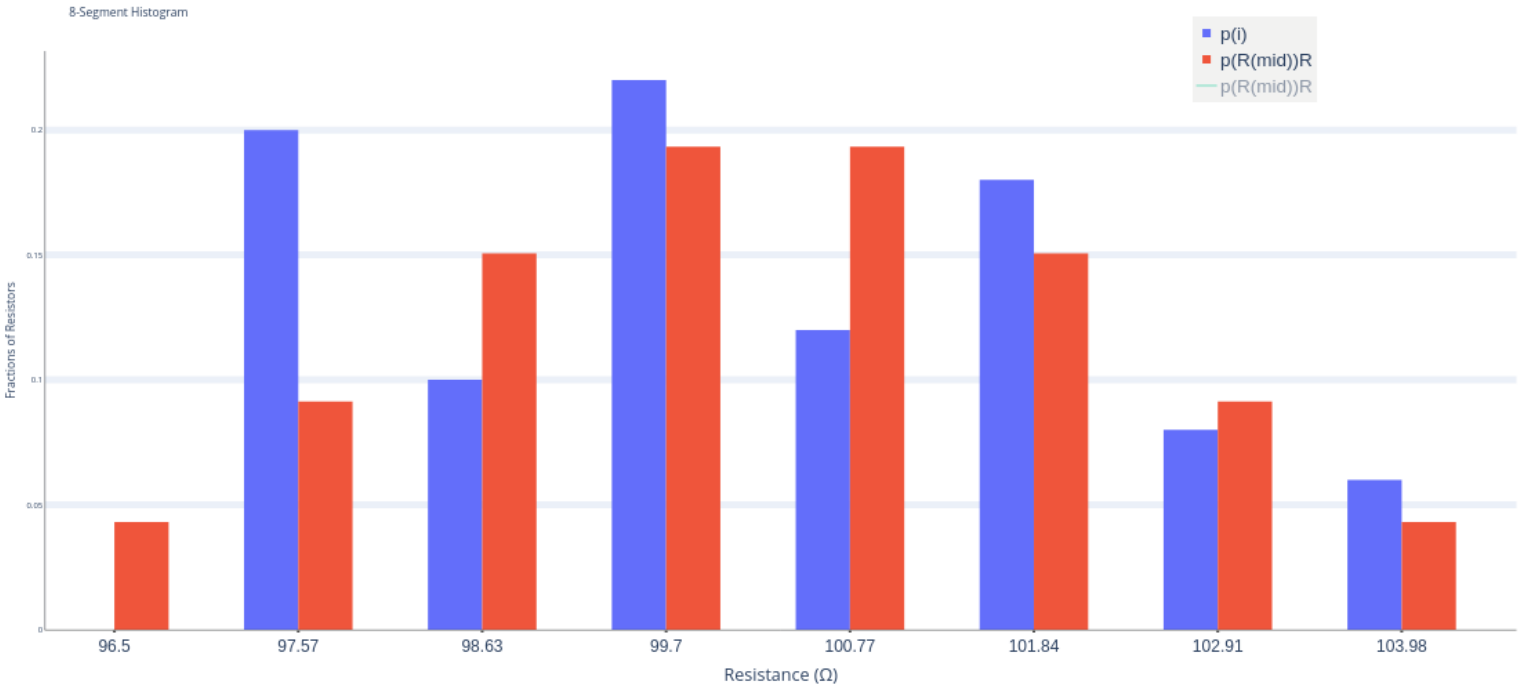
5. Include your plot of your 8-segment histogram data.



Full Image: https://drive.google.com/file/d/176J2gQQg0iLFQ29ik9x4sp5s6hZJpu4z/view?usp=sharing

6. Include a table for your 16-segment histogram.

bar marks	i	R(i) Ω	R(i+1) Ω	R(mid) Ω	n(i)	P(i)	p(R(mid))	p(R(mid))ΔR
-2	1	96.49557	97.03037	96.76297	0	0.000	0.03215489	0.034393138
-1.75	2	97.03037	97.56517	97.29777	0	0.000	0.04980246	0.053269134
-1.5	3	97.56517	98.09998	97.83258	1	0.020	0.07246215	0.077506133
-1.25	4	98.09998	98.63478	98.36738	9	0.180	0.09904402	0.105938323
-1	5	98.63478	99.16959	98.90219	4	0.080	0.12717504	0.136027499
-0.75	6	99.16959	99.70439	99.43699	1	0.020	0.15340238	0.164080484
-0.5	7	99.70439	100.23920	99.97179	3	0.060	0.17382767	0.185927547
-0.25	8	100.23920	100.77400	100.50660	8	0.160	0.18503859	0.197918843
0	9	100.77400	101.30880	101.04140	3	0.060	0.18503859	0.197918843
0.25	10	101.30880	101.84361	101.57621	3	0.060	0.17382767	0.185927547
0.5	11	101.84361	102.37841	102.11101	5	0.100	0.15340238	0.164080484
0.75	12	102.37841	102.91322	102.64581	4	0.080	0.12717504	0.136027499
1	13	102.91322	103.44802	103.18062	2	0.040	0.09904402	0.105938323
1.25	14	103.44802	103.98283	103.71542	2	0.040	0.07246215	0.077506133
1.5	15	103.98283	104.51763	104.25023	3	0.060	0.04980246	0.053269134
1.75	16	104.51763	105.05243	104.78503	0	0.000	0.03215489	0.034393138
2								

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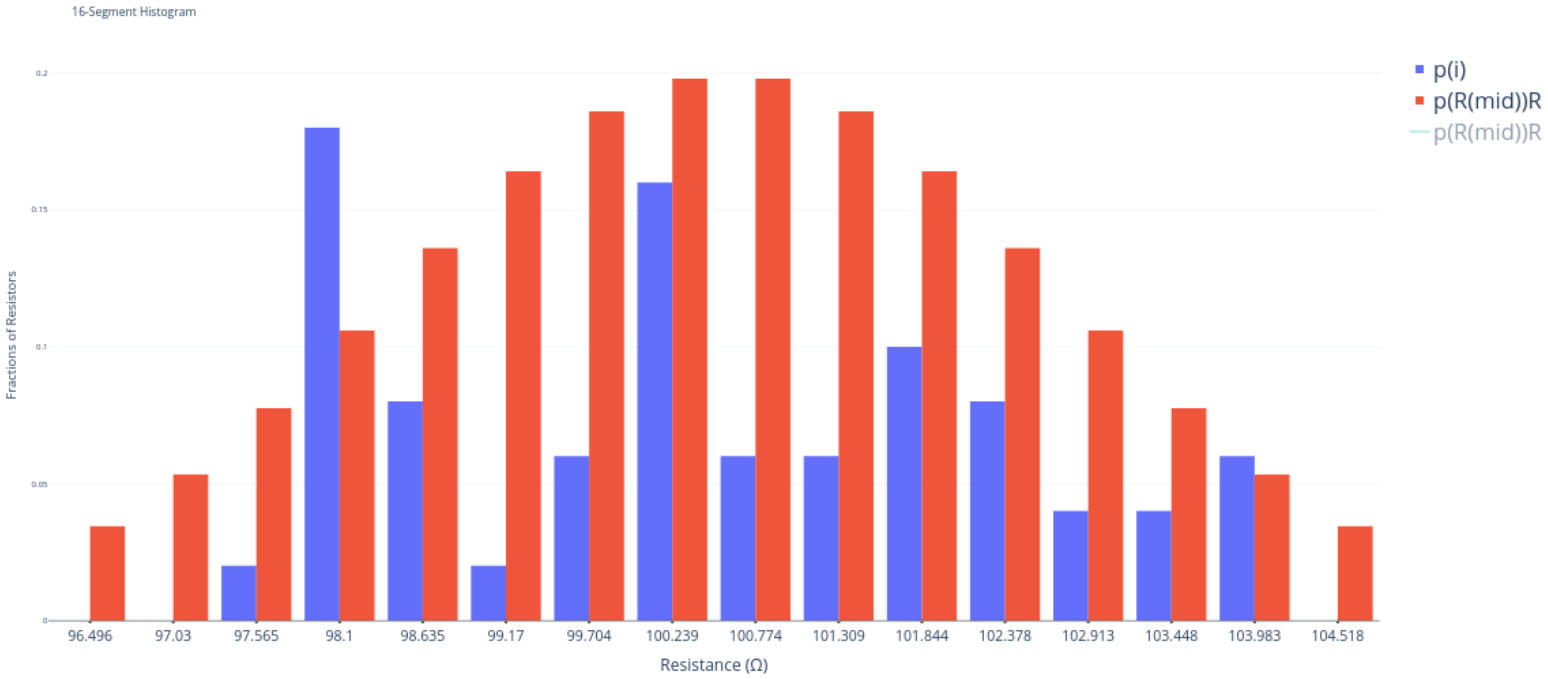
7. Include your plot of your 16-segment histogram.



Full Image: https://drive.google.com/file/d/19uvnp4hsgs43TnFbxWzS9TR3_bpYwrD5/view?usp=sharing

8. Respond to the following questions/instructions:
   (a) Using either histogram, what fraction of all your resistors are within $R^{\bar{}} \pm \sigma$? within $R^{\bar{}} \pm 2\sigma$? outside of $R^{\bar{}} \pm 2\sigma$?

   For 8-Segmented Histograms,

   Each bar represents 6 resistors. If $R^{\bar{}} \pm 2\sigma$ represents the whole 8-bar segments, $R^{\bar{}} \pm \sigma$ would represent only 4 bar/segments, in that case, only 24 resistors. Outside $R^{\bar{}} \pm 2\sigma$, only 2 resistors.

   For 16-Segmented Histograms,
   Each bar represents 3 resistors. If $R^{\bar{}} \pm 2\sigma$ represents the whole 16-bar segments, $R^{\bar{}} \pm \sigma$ would represent only 8 bar/segments, in that case, only 24 resistors. Outside $R^{\bar{}} \pm 2\sigma$, only 2 resistors.

   (b) Based on your results, if your resistors had a colour coding what should that colour coding be? Justify your answer.

   (c) Which of the two histograms that you made looks most like the idealized histogram you were expecting? Justify your answer/explain why this is this way.

   I think the 16-Segmented Histogram looked like the most idealized histogram, as there were more divisions in smaller segments, and thus, more data was represented in more bars. As the data was diversed by more segments, so more idealized the data.