ECEN321 : Engineering Statistics
Assignment 10 Submission

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Hypothesis Tests

1. (Navidi 6.7.2)
   $x = disk:\ n_x = 6,\ \bar{x} = 255.8,\ s_x^2 = 67.51,\ s_x = 8.216$
   $y = oval:\ n_y = 8,\ \bar{y} = 270.74,\ s_y^2 = 141.68,\ s_y = 11.9$

   Given claim that $\mu_x \neq \mu_y$:
   $$H_0\ :\ \mu_x = \mu_y$$
   $$H_a\ :\ \mu_x \neg \mu_y$$
   Compute v:
   $$v\ = \frac{\left(\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}\right)^2}{\frac{\left(\frac{s_x^2}{n_x}\right)^2}{n_x - 1} + \frac{\left(\frac{s_y^2}{n_y}\right)^2}{n_y - 1}} = 11.9 \to 11$$
   Test Statistic t:
   $$t = \frac{(X - Y) - (0)}{\sqrt{\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}}} = -2.77$$
   From student t table (two tailed at df=11): P = 0.02
   Given the low probability of this occurrence the null hypothesis can be rejected.

2. (Navidi 6.8.6)
   D = 3.1, -1.2, 0.4, -0.4, -3.1, -7.7 $\bar{D} = -1.483,\ s_D^2 = 13.414,\ s_D = 3.66$
   $n = 6,\ df = n - 1 = 5\ H_0 : \mu_D = 0$
   $$t = \frac{D - 0}{\frac{s_{\bar{D}}}{\sqrt{n}}} = \frac{-1.483}{\frac{3.66}{\sqrt{6}}} = -0.9925$$
   From student t table (two tailed at df=5): P = 0.4
   Null hypothesis cannot be rejected.

3. (Navidi 6.9.8) $n_X = n_Y = 15$ $H_0 : \mu_X \geq \mu_Y$

1	1255	X
2	1255	X
3	1270	X
4	1280	X
5	1287	X
6	1291	X
7	1296	X
8	1301	Y
9	1302	X
10	1306	X
11	1310	X
12	1314	X
13	1318	X
14	1321	Y
15	1326	X
16	1328	X
17	1329	X
18	1332	Y
19	1341	Y
20	1343	Y
21	1349	Y
22	1364	Y
23	1372	Y
24	1374	Y
25	1376	Y
26	1387	Y
27	1396	Y
28	1397	Y
29	1398	Y
30	1399	Y
Wx	Wy	
131	334	

$$z = \frac{W_X - \frac{n_X(n_X+n_Y+1)}{2}}{\sqrt{\frac{n_X n_Y(n_X+n_Y+1)}{12}}} = \frac{131 - \frac{15(31)}{2}}{\sqrt{\frac{15^2(31)}{12}}} = -4.2100$$

$$P(Z < -4.21) \approx 0$$

Therefore there is sufficient evidence to reject the null, and accept the claim that "the mean strength is greater for blocks cured for six days."

4. (Navidi 6.10.4

H_0: That the model **does** explain the values.

O	**E**	$\frac{(O-E)^2}{E}$	χ^2 ie the sum
18	23	1.086956522	21.47460834
28	18	5.555555556	
14	16	0.25	
7	13	2.769230769	
11	11	0	
11	9	0.4444444444	
10	20	5	
8	8	0	
30	19	6.368421053	

$$\chi^2 = \sum(\frac{(O-E)^2}{E}) = 21.47$$
$$df = 9 - 1 = 8$$

From table:

$$P = [0.01, 0.005]$$

The p-value is low enough to reject the null and support the claim that "the theoretical model does not explain the observed values well."