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### Assignment - 1

Q.1)

i) From the excel sheet below

$$d_{\text{mean}} = -0.105263$$

$$\text{Standard deviation} = 0.1747178$$

$$t = \frac{d_{\text{mean}}}{s.d / \sqrt{n}}$$

$$\Rightarrow t = \frac{-0.105263}{\frac{0.1747178}{\sqrt{19}}} = -2.626125$$

$$t_{\text{calculated}} = -2.626125$$

For paired t-test, degree of freedom = 19-1  
= 18

→ For 95% confidence & df = 18

$$t_{\text{critical}} = 2.101 \text{ (from } t \text{ Table)}$$

$$|t_{\text{calculated}}| > t_{\text{critical}}$$

→ It concludes that there is a significant difference between the ~~max~~ agency measurements and the measurements from the vendor's sensor data.

ii) From the excel sheet below

$$d_{\text{mean}} (\text{mean difference}) = -0.105263$$

$d_{\text{mean}} < 0$ ; It indicates that the ~~estimated~~ pavement condition is overestimated.

S.No	IRI_Agency	IRI_Vendor	Difference	Percentage Error
1	1.6	1.4	0.2	-12.5
2	6.4	6.5	-0.1	1.5625
3	8	7.9	0.1	-1.25
4	3.2	3.3	-0.1	3.125
5	4.1	4.4	-0.3	7.317073171
6	3.4	3.7	-0.3	8.823529412
7	3.4	3.6	-0.2	5.882352941
8	2.2	2.6	-0.4	18.18181818
9	5	5	0	0
10	4.6	4.6	0	0
11	2.4	2.6	-0.2	8.333333333
12	5.6	5.4	0.2	-3.57142857
13	4.1	4.1	0	0
14	2	2	0	0
15	3.1	3.4	-0.3	9.677419355
16	4.6	4.6	0	0
17	2.8	3.1	-0.3	10.71428571
18	4.9	5.1	-0.2	4.081632653
19	5	5.1	-0.1	2
		Mean =	-0.105263	3.283027168
		Standard Deviation=	0.1747178	

iii)

$$\text{Percentage error} = \frac{\text{Vendor-IRI} - \text{Agency-IRI}}{\text{Agency-IRI}} \times 100$$

The % errors are calculated in the excel sheet

$$\text{Mean \% error} = \frac{\sum \% \text{ percentage error}}{n}$$

$$= +3.28302\%$$

Since, Mean % error  $\in [-5\%, +5\%]$ , so, the automated equipment is acceptable.