	A	B	C	D	E	F	G	H	I	J
1	**Batch**	**Agent1**	**Agent2**					t-Test: Paired Two Sample for Means		
2	1	7.7	8.5							
3	2	9.2	9.6						*Agent1*	*Agent2*
4	3	6.8	6.4					Mean	8.25	8.683333333
5	4	9.5	9.8					Variance	1.059091	1.077878788
6	5	8.7	9.3					Observations	12	12
7	6	6.9	7.6					Pearson Correlation	0.901056	
8	7	7.5	8.2					Hypothesized Mean Difference	0	
9	8	7.1	7.7					df	11	
10	9	8.7	9.4					t Stat	-3.26394	
11	10	9.4	8.9					P(T<=t) one-tail	0.003773	
12	11	9.4	9.7					t Critical one-tail	1.795885	
13	12	8.1	9.1					P(T<=t) two-tail	0.007546	
14								t Critical two-tail	2.200985	
15										
16								Difference in means	-0.43333	
17										
18							**Exercise 7.1 One tailed test:**	To determine whether Filter Agent 1 is significantly more effective than Filter		
19								Agent 2, based on data from 12 matched batches. A one-tailed paired-sample t-		
20								test was conducted to test this hypothesis.		
21								H0:μd =0(No difference in mean effectiveness)		
22								$H1{:}\mu d>0$ (Filter Agent 1 is more effective than Agent 2)		
23								where d =Agent 1 – Agent 2		
24								For a one-tailed test at the 5% significance level $\alpha=0.05\alpha$ and df =11 t		
25								critical=+1.796		
26								The observed value $t=-3.27$ lies far below zero.		
27								Corresponding p-value ≈ 0.901, meaning there is almost no probability that		
28								Agent 1 exceeds Agent 2.		
29								Since $t<tcritical$ and $p>0.05$		
30								Fail to reject $H0$		
31										
32								There is no statistical evidence to support that Filter Agent 1 is more effective		
33								than Filter Agent 2.In fact, the negative mean difference (−0.433) indicates that		
34								Agent 2 performed slightly better on average.		
35										
36								At the 5% level of significance:		
37										
38								The observed results suggest that Filter Agent 2 consistently produced higher		
39								effectiveness readings than Agent 1. Hence, conducting a one-tailed test for Agent		
40										
41										
42										
43										
44							**Exercise 7.3 Two tailed test:**	H0:μd=0(No mean difference between impurities)		
45								$H1{:}\mu$d≠0(Mean impurity differs between the agents)		
46								where d=Agent 1–Agent 2		
47										
48								For a two-tailed test at		
49								α=0.05 $tcritical$=±2.201		
50								Computed $|t|$=3.27>2.201so we reject $H0$		
51								p-value ≈ 0.0075 (two-tailed).		
52								At the 5% significance level:		
53										
54								The mean impurity level for Filter Agent 1 (mean = 8.25) differs significantly		
55								from that of Filter Agent 2 (mean = 8.68).		

The negative mean difference (−0.433) indicates that Agent 1 yields slightly lower impurity levels on average than Agent 2.

Thus, there is strong evidence that the population mean impurity differs between the two agents, with Agent 1 performing marginally better (i.e., producing purer output).