Exercise 7.1

Summary of Results:

t-Test: Paired Two Sample for Means		
	Agent1	Agent2
Mean	8.25	8.683333333
Variance	1.059090909	1.077878788
Observations	12	12
Pearson Correlation	0.901055812	
Hypothesized Mean Difference	0	
df	11	
t Stat	-3.263938591	
P(T<=t) one-tail	0.003772997	
t Critical one-tail	1.795884819	
P(T<=t) two-tail	0.007545995	
t Critical two-tail	2.20098516	

Note: Data Excel Workbook for Exercise 7.1 is extracted from Exa 8.4G.xlsx. The summary table findings are based on the analysis of this data.

Interpretation:

- One-tailed p-value: 0.0038 (two-tailed p-value /2)
- Since p = 0.0038 is less than 0.05, we reject the null hypothesis.

There is strong evidence that Filter Agent 1 works better (produces lower impurity) than Agent 2.

Exercise 7.2

Summary of Results:

Metric	Value
Mean Income – Males	53.12
Mean Income – Females	44.42
Mean Difference (M - F)	8.70
t-Statistic	3.23859769439459
Degrees of Freedom	115
p-value (One-Tailed)	0.00079
Conclusion	Significant: Males earn more

Note: Data Excel Workbook for Exercise 7.2 is extracted from Exa 8.6C.xlsx. The summary table findings are based on the analysis of this data.

Interpretation:

Since p = 0.0007 is less than 0.05, we reject the null hypothesis. There is strong statistical evidence that males have a higher mean income than females.

t-Test: Two-Sample Assuming Unequal Variances

p-value (one-tail) = 0.00079 is less than 0.05, and

t Stat = 3.239 is greater than t Critical = 1.658.

we reject the null hypothesis and conclude that there is strong statistical evidence the mean income of males is significantly higher than that of females in this sample.

Exercise 7.3

Summary of Results:

Metric	Agent 1	Agent 2
Sample Size (n)	12	12
Mean	8.25	8.6833
Variance	1.0591	1.0779
Mean Difference (A1 - A2)	-0.4333	—
Degrees of Freedom (df)	11	—
t Statistic	-3.2639	—
p-value (two-tailed)	**0.00755**	—

Note: Data Excel Workbook for Exercise 7.3 is extracted from Exa8.4G.xlsx. The summary table findings are based on the analysis of this data.

Interpretation

The two-tailed p-value = 0.00755 is less than 0.05, so we reject the null hypothesis at the 5% significance level.

This shows there is significant evidence that the mean impurity differs between Agent 1 and Agent 2.

This test suggests that Agent 1 performs better than Agent 2 in reducing impurity, based on the data from the 12 paired batches.

Exercise 7.4 – One-Tailed Paired t-Test Results Table

Summary of Results:

Metric	Value
Number of Pairs (n)	12
Mean (Agent 1)	8.083
Mean (Agent 2)	8.675
Mean Difference (Agent1 - Agent2)	-0.592
Standard Deviation of Differences	~0.467
Degrees of Freedom (df)	11
t Statistic	-3.2639
One-tailed p-value	**0.0038**
Significance Level (α)	0.05
Test Direction	Agent 1 < Agent 2

Note: Data Excel Workbook for Exercise 7.4 is extracted from Exa8.4G.xlsx. The summary table findings are based on the analysis of this data

Interpretation

There is strong evidence at the 5% significance level that Filter Agent 1 is more effective than Filter Agent 2. Agent 1 results in significantly lower impurity levels across the 12 batches.

• The negative t-statistic (–3.26), which matches the direction of the test (Agent 1 < Agent 2),

• The strong correlation (Pearson = 0.90) between paired values, confirming the use of a paired test.

Exercise 7.5

Summary of Results:

Statistic	Male	Female
Sample Size (n)	59	59
Mean	53.12	44.42
Variance	234.49	191.28
Degrees of Freedom (df)	115	—
t Statistic	3.2386	—
One-tailed p-value	0.000785	—
t Critical (one-tail, α=0.05)	1.6582	—

Note: Data Excel Workbook for Exercise 7.3 is extracted from Exa8.6C.xlsx. The summary table findings are based on the analysis of this data.

Interpretation:

• p = 0.000785 < 0.05,
• and t = 3.2386 > t critical = 1.6582,
we reject the null hypothesis.

There is strong statistical evidence to conclude that the average income for males is significantly higher than that of females in this dataset. This supports the claim that there is a gender income gap, with males earning more on average than females.