Problem 1

Part - 1 Testing the mean

Step1: Hypothesis

Null Hypothesis: H_0: $\mu = 0$

Alternative Hypothesis: H_a: $\mu \neq 0$

Step2: Test Statistic

One-sample t-statistic

$t = (\bar{x} - \mu_o) / (s/\sqrt{n})$

$t = (0.02133 - 0) / (0.25626/ \sqrt{15})$

Step3: Rejection Region

For a two–tailed test at $\alpha = 0.05$ with n – 1 degrees of freedom (df = 14), the critical t–values are $\pm t_{14,0.025}$

Is ±2.1448

Step4: Compute test statistic

$t = (0.02133 - 0) / (0.25626/ \sqrt{15})$

$t = 0.3224$

Ste5: Decision and interpretation

As 0.3223 is less than the critical value 2.1448 we fail to reject the null hypothesis. The data provides insufficient evidence to prove that the mean gain/loss is zero.

P-value :

$p = 2[1 – P(T \leq |t|)]$ or $p = 2pr(T > 0.3224)$

p = 2 * (1 - pt(abs(t_stat), df))

p = 0.75

Confidence Interval:

95% CI for μ: $\bar{x} \pm t_{0.025} \cdot (s/\sqrt{n})$

$0.02134 \pm 2.1448 * (0.25626/ \sqrt{15})$

95% CI for μ: (-0.1206 , 0.1632)

Based on p value and CI confirms we fail to reject H_0. The data provides insufficient evidence to prove that the mean gain/loss is zero.

Part - 2

The manufacturer claims that at least 95% of watches are accurate to within ±0.2 seconds per week. We'll test this claim using the sample proportion method at a 5% significance level (α=0.05)

Hypothesis

Null Hypothesis H_0: $p \geq 0.95$ (at least 95% of watches are within ±0.2 seconds)

Alternative Hypothesis H_a : $p < 0.95$ (less than 95% of watches are within ±0.2 seconds)

Sample proportion

n = 15, values outside ±0.2 = 2, values inside ±0.2 = 13

phat = 13/15 = 0.8666

binary outcome with in or without ±0.2, one-tailed binomial test, alpha = 0.05

```
test_result <- binom.test(13, 15, p = 0.95, alternative = "less")
test_result
```

Exact binomial test

```
data:  successes and n
number of successes = 13, number of trials = 15, p-value = 0.171
alternative hypothesis: true probability of success is less than 0.95
95 percent confidence interval:
 0.0000000 0.9757743
sample estimates:
probability of success
             0.8666667
```

P - value = 0.171

Confidence interval = [0, 0.9757]

p-value(0.171) > 0.05, we fail to reject the null hypothesis and data does not provide sufficient evidence to reject the manufacturer's claim that at least 95% of the watches are accurate to within ±0.2 seconds per week at the 5% significance level.