t_test_1_samp_HW

This is a minimal key to help you check if you did the tests properly.

Answer each question. Perform all necessary tests. Perform transformations on the data if required.

Question 1:

These are the test scores of 12 students on a quiz. The quiz was out of 100 points. Suppose we want to test whether the mean score differs significantly from a predicted average of 70.

```
quiz_scores <- c(75, 82, 68, 90, 73, 85, 77, 79, 88, 91, 83, 80)
```

- State the **null and alternative hypotheses**.
- Are these data normal?

Yes these are normal.

- Is the mean score significantly different from the expected result?

Yes, the test score is significantly different than expected ($t_{11} = 5.39$, $p = 0.0002$).

- Did the students do better or worse than expected, if there is a difference?

Better, value is higher.

- Perform one-sided test

One-tailed is still significant ($t_{11} = 5.39$, $p = 0.0001$).

Question 2:

The following is a list of reported study hours for Biostats per week. We expect the class average to be about three hours a week. Using this dataset, answer the following questions:

- State the **null and alternative hypotheses**.
- Are these data normal?

Yes, these data are normal.

- Do students spend the expected amount of time studying per week?

Yes, they spend 3 hours on average studying ($t_9 = -0.48$, $p = 0.64$).

- Do students spend more or less time studying per week, if there is a difference?

There is no significant difference; mean is slightly lower.

Question 3:

The following dataset records the reaction times of people who have had less than three hours of sleep on the night before this test. Using the reaction time column, perform a t-test to determine if these people have a statistically different reaction time than the human average (250 ms).

- State the **null and alternative hypotheses**.

- Are these data normal?

These data are not normal ($W = 0.97$, $p = 0.0008$).

A transformation is needed, and one specific transformation is successful.

- Is the mean score significantly different from the expected result?

Yes, the score is different ($t_{179} = 11.59$, $p < 0.0001$).

- Are the people in the dataset slower or faster than average, if there is a difference? What might be the reason for this?

The reaction time is slower; 293.427 ms.

- One-tailed test

The reaction time is significantly greater than expected ($t_{179} = 11.59$, $p < 0.0001$).

Question 4:

Whole milk is expected to be around 3.25% fat. Researchers from Florida wanted to determine if this was the case and used two methods to measure the fat percentage in the milk they tested. Using the enzymatic method ($triglyceride), determine if the fat percentage of this milk was significantly different from the 3.25% expected.

- State the **null and alternative hypotheses**.
- Is the mean score significantly different from the expected result?

The milk is significantly different than the expected mean (t_{44} = -2.37, $p = 0.02$).

- Is the milk fattier or leaner than expected, if there is a difference?

Leaner; $p = 0.02$, $mu = 2.80$.

- One-tailed

It is less ($t_{44} = -2.37$, 0.01)

Question 5:

Galaxies are rapidly moving away from us at various speeds. Previous studies had offered an average recession rate of 20,000 km/s. Data collected using redshift allows us to calculate the actual speed of recession of a galaxy. Using the data from R. J. Roeder (1990), saved as "galaxies", determine if the average galaxy is actually receding at the previously estimated rate.

- State the **null and alternative hypotheses**.
- Is the mean score significantly different from the expected result?
- Are the galaxies moving away faster or slower, if there is a difference?

They are moving significantly faster. $p = 0.003$.