MIS771 Descriptive Analytics and Visualisation	DEAKIN UNIVERSITY
MIS771 Lecture Topic 2 – Brief Solutions	

Exercise 1

A recent NSW study found that, on average, households spend $232 a week on groceries. A retail organisation wishes to determine if Victorian households differ in their average spending on groceries. They take a random sample of 64 Victorian households and obtain a sample mean of $215 with a standard deviation of $56.

    a) Use α = 2% to test the claim.

Write down the null and alternative hypotheses in words **and** symbols.

H_o: $\mu = 232$ (Symbols)

                                         (Words)

H_a: $\mu \neq 232$ (Symbols)

                                         (Words)

Two tail

Critical values of t = +/-2.387

If the sample statistic is < -2.387 or > +2.387 then reject H_0

t = -2.43

Reject H_0

At 2 percent significance, there is enough evidence to conclude that Victorian households differ in their average spending on groceries compared to NSW.

    b) Could you have come to a different decision if α = 1%?

    Yes, because *p*-value > 1%.

Exercise 2

In a large organisation, currently 7.5% of all deliveries from suppliers arrive late. A supply chain manager is considering implementing a new system with its suppliers in order to reduce the number of late deliveries received by the organisation. It is estimated that the new system would cost approximately $200,000.

    a) Before deciding whether to purchase the new system, a trial was conducted in which a random sample of 120 deliveries revealed only 6 were late. Is there sufficient evidence to conclude that the new system is better than the previous one? Use α = 10%.

Write down the null and alternative hypotheses in words **and** symbols.

H_o: $\pi \geq 7.5\%$_____(Symbols)

_____(Words)

H_a: $\pi < 7.5\%$_____(Symbols)

_____(Words)

low tail

Critical values of z = -1.28

If the sample statistic is < -1.28 then reject H_0

z = -1.04

Fail to reject H_0

At 10 percent significance, there is NOT enough evidence to conclude that the new system is better.

    b)   Would the p-value be higher or lower than 10%? Explain.

Greater than 10% as we have failed to reject H_0

    c)   Write down what the Type I and Type II errors would be in this scenario.

Type I: Concluded that the new system was better when in fact it is not better.
Type II: Concluded that the new system didn't improve the percentage of deliveries arriving late when in fact it is a better system.

    d)   Do you think α = 10% was appropriate for this scenario and should the company purchase the new system?

Seems too high given the large amount of money potentially being spent on the new system ($200,000) and not based on the evidence collected so far.

Exercise 3

An Equal Opportunity Officer wishes to compare the average amount of unpaid overtime worked by female and male employees in an organisation. A random sample is taken and the results are as follows:

Females: $n_1 = 32$, $x_1 = 8.2$, $s_1 = 2.8$
Males: $n_2 = 36$, $x_2 = 6.1$, $s_2 = 2.4$

    a) Is there a significant difference between unpaid overtime worked by females and males?

    Write down the null and alternative hypotheses in words **and** symbols.

H_o:_____$\mu_1 - \mu_2 = 0$_____(Symbols)

_____(Words)

H_a: $\mu_1 - \mu_2 \neq 0$_____(Symbols)

_____(Words)

    b) If so, provide an accurate estimate of the difference.

We are 95% confident that female employees work on average somewhere between 0.84 hours to 3.36 hours more unpaid overtime than male employees.

Exercise 4

Management at an organisation have implemented a new training program with the aim of improving productivity. 36 staff were randomly chosen to pilot the training program with the following results:

Productivity (after): $x_1 = 101.5$
Productivity (before): $x_2 = 99.0$

    a) Has there been a significant improvement in productivity after the training program? [Note: standard deviation of differences is 2.8]

Write down the null and alternative hypotheses in words **and** symbols.

H_o: _____$\mu D \leq 0$_____(Symbols)

            _____(Words)

H_a: _____$\mu D > 0$_____(Symbols)

            _____(Words)

Upper tail

Critical values of t = 1.69

If the sample statistic is > +1.69 then reject H_0

t = 5.36

Reject H0

At 5 percent significance, there is enough evidence to conclude that the average productivity has improved for those employees who completed the training program.

b) Suppose Management decided to only implement the training program to ALL employees if it can be demonstrated that the program improves productivity by more than 2%. Should they implement the training for ALL employees?

We are 95% confident that the average improvement in productivity for all employees after completing the training is somewhere between 1.55% and 3.45%.

Cannot conclude that productivity has improved by more than 2%. Don't implement.

Exercise 5

Is there a smaller proportion of non-union members who feel 'insecure' in their job compared to employees who are union members?

Non-union: $n_1 = 25$, $p_1 = 6/25 = 24.0\%$
Union: $n_2 = 23$, $p_2 = 8/23 = 34.8\%$

Conduct a hypothesis test using $\alpha = 10\%$.

H_0: $\pi_1 - \pi_2 \geq 0$

The proportion of non-union members who feel 'insecure' is the same or more than that of union members.

H_1: $\pi_1 - \pi_2 < 0$

The proportion of non-union members who feel 'insecure' is less than that of union members.

Low tail test

Z-statistic = -0.821

Z-statistic of -0.821 is NOT less than the CV of Z of -1.28

Fail to Reject H_0.

At 10 percent significance, there is insufficient evidence to conclude across the whole workforce that a smaller proportion of non-union employees feel 'insecure' compared to union employees.