Question 1 - NJC/RI Tutorial modified

A security guard investigated the speed of vehicles, x km/h, within school compounds. The random variable, X, is known to have a normal distribution with mean 22 and variance 36. The mean of the distribution of X is denoted by μ.

A random sample of 50 cars was observed and it is found that the sample mean is 20.2 km/h. Test whether this provides significant evidence at 5% level that the security guard overstated the mean.

[p-value = 0.0169473661/ z-value = -2.21320344 $< z_{crit}$ = -1.644853626, reject H_0]

Question 2

The mass of apples in an orchard is normally distributed and has mean μ grams and standard deviation of 10 grams. The owner of the orchard claims that $\mu = 250$ grams.

A random sample of 50 apples is collected and the sample means is found to be 248 grams.

Test whether this provides significant evidence at 5% level that the orchard owner overstated the value of μ.

[p-value = 0.0786496525/ z-value = -1.414213562 $> z_{crit}$ = -1.644853626, do NOT reject H_0]

Question 3 - Sample data in Sigma Notation form

Large sized soft drink are sold in 1.5 litre bottle. A sample of 40 bottles was selected at random and the volumes, x, measured in litres, are noted.

Assuming that the volume of the bottles follow a normal distribution with variance = 0.01 litres^2, test, at a 1% significance level, whether the bottles are under filled if the following results were obtained from sampling:

$$\sum(x+0.1) = 63 \text{ and } \sum(x+0.1)^2 = 99.47$$

[p-value = 0.0569231524/ z-value = -1.58113883> z_{crit} = -2.326347877 do NOT reject H_0]

Question 4 - Sample data in Sigma Notation form

Try Question 3 again but this time, assume the population variance is unknown.

[p-value = 0.0230272911/ z-value = -1.994891432 < z_{crit} = -1.644853626, reject H_0]

Question 5 - Sample data in raw form - EJC Tutorial

A machine packs flour into bags. A random sample of eleven filled bags was taken and the masses of the bags to the nearest 0.1 g were:

$$1506.8, 1506.6, 1506.7, 1507.2, 1506.9, 1506.8, 1506.6, 1507.0, 1507.5, 1506.3, 1506.4.$$

(i) Obtain the mean and the variance of this sample.

[$\bar{x} = 1506.8$, $\sigma_x = 0.109090909...$]

(ii) Filled bags are supposed to have a mass of 1506.5 g. Assuming that the mass of a bag has normal distribution with variance 0.16 g^2, test whether the sample provides significant evidence at the 5% level that the machine produces overweight bags.

[p-value $= 0.0064328026$/ z-value $= 2.487468593 > z_{crit} = 1.644853626$, reject H_0]

(iii) Explain what you understand by "5% level of significance" in the context of this question.

[There's a 5% chance that the test concludes the machine produces overweight bags when it actually does not]

Question 6 - sample data in Sigma notation form - (9758/2017/II/Q7 MODIFIED)

The manager of a factory producing electrical appliances wishes to take a random sample of a certain type of display monitor from the thousands produced one day at his factory, for quality control purposes. He wishes to check that the power rating of these monitors is 32 Watts, as stated per specifications.

The power rating, x Watts, of a random sample of 40 display monitors are summarised as follows.

$$\sum(x-32) = -7.7 \quad \sum(x-32)^2 = 11.05$$

(i) State what it means for a sample to be random in this context.

(ii) Calculate unbiased estimates of the population mean and variance of the power rating of display monitors.

[$\bar{x} = 31.8075$, $s^2 = 0.2453269231$]

(iii) Test, at the 1% level of significance, the claim that the mean power rating is 32 Watts. You should state your hypotheses and define any symbols you used.

[p-value = 0.0139699537/ z-value = -2.458035345 $> z_{crit}$ = -2.575829303, do NOT reject H_0]

(iv) Explain why there is no need for the manager to know the population distribution of the masses of the biscuit bars