# STATISTICS ASSIGNMENT

**for**

**MSc in PVT 2020**

(Please note that while the use of computer software is encouraged for performing calculations, a ‘bare’ computer printout of results will not be deemed acceptable for the purposes of your assignment submission. The rationale for choosing a particular statistical test should be given and the results of the test fully discussed.)

1. (a) Quality control records show that the average tablet weight to be 499 mg with a standard deviation of 5.3. There are sufficient data so that these values may be considered known parameters (**population** mean and std. dev.). A new batch shows the following weights from a random sample of seven tablets: 500, 499,495, 493, 497, 504 and 495 mg . Do you believe that the new batch has a different mean from the process average?

(b) Two batches of tablets were prepared by two different processes. The potency determinations made on five tablets from each batch were as follows: batch A: 5.1, 4.9, 4.6, 5.3, 5.5, 4.7; batch B: 4.8, 4.8, 5.2, 5.0, 4.5, 4.4. Test to see if the means of the two batches are equal.

(c) What is the answer to part (a) if the variance was unknown. Place (i) a 95% and (ii) a 99% confidence interval on the true average weight.

[25 marks]

1. The following analytical data were obtained for a spectrophotometric analysis:

Conc.(mg dm3) Absorbance

1. 0.105, 0.088
2. 0.205, 0.185
3. 0.495, 0.510
4. 0.983, 1.120

200 1.964, 2.018

1. compute r and r2, and explain what their values indicate,
2. find the regression equation of absorbance on concentration,
3. predict the concentration , if the absorbance was 0.680.
4. plot the residuals from the regression analysis against the concentration. What does the resulting pattern indicate?

[25 marks]

1. The number of days since the appearance of a tumour in an animal, and the size of the tumour, are shown below:

Days 14 16 19 21 23 26 28 30 33

Size(cm3) 1.25 1.90 4.75 5.45 7.53 14.5 16.7 21.0 27.1

Construct the **best** regression that you can find, and use the model to estimate the size of the tumour after 24 days.

[25 marks]

(a) Test the hypothesis that the average dissolution time is 20 seconds, using the random sample of dissolution times below.

Dissolution time (secs): 23 19 26 22 18 27

(b) Two different instruments were used to make a number of replicate measurements. The results were:

Instrument A: 12.06 12.14 12.03 12.09 12.05

Instrument B: 14.62 14.97 14.60 14.51 14.01 14.11

Do these results indicate that either instrument is more precise?

[25 marks]

1. Dissolution is compared for three experimental batches of tablets with the following results (each point is the time in minutes for 50% dissolution for a single tablet).

Batch 1: 15 18 19 21 23 26

Batch 2: 13 10 16 11 9

Batch 3: 17 18 24 20

1. Is there a significant difference between batches?
2. Which batch is different? [25 marks]
3. Tablets were made on six different tablet presses from ten available presses during the course of a run (batch). One tablet from each press were collected during each hour of the 4-hour run. The tablets were then assayed in random order. The results are as follows:

**Press**

Hour 1 2 3 4 5 6

1 47 49 46 49 47 50

2 48 48 48 47 50 50

3 50 47 50 48 51 50

4 49 46 50 49 47 49

Is there any variation as a function of the press or the time? [50 marks]

1. Samples of weights were collected ( 5 samples per day ) for 40 days they are listed in the EXCEL file. Use this data to construct an Xbar and R chart for weights. State the LCL and the UCL Is the process in control?

Given that the upper specification limit is 630 and the lower specification limit is 610, calculate the Cp and the Cpk. Take the target mean to be 620 ( rather than the actual mean of 620.54) Is the process capable?

[25 marks]