MATU9D2 : PRACTICAL STATISTICS
WEEKLY ASSIGNMENT 7 : SOLUTIONS

ALL TESTS WILL BE PERFORMED AT 5% SIGNIFICANCE LEVEL IN THE ASSIGNMENT

1. The appropriate formal statistical technique to use and interpret a χ^2 confidence interval. This also assumes that the data is Normally distributed. This assumption was validated in (i) using the Normal Probability Plot.

$$H_0: \sigma = 10 \quad \textit{where } \sigma \textit{ is the population standard deviation in radon level}$$
$$H_1: \sigma \neq 10$$

Figure 1 and **Table 1** show that the 95% confidence interval for the population standard deviation in radon level is from 6.6 picocuries/litre and 15.96 picocuries/litre. i.e. 95% confident that true standard deviation in mean radon level lies within this range.

In particular, 10 is within this interval so we cannot reject H_o in favour of H_1 at 5% level i.e insufficient evidence that the standard deviation in radon level differs significantly from 10 picocuries per litre.

Figure 1

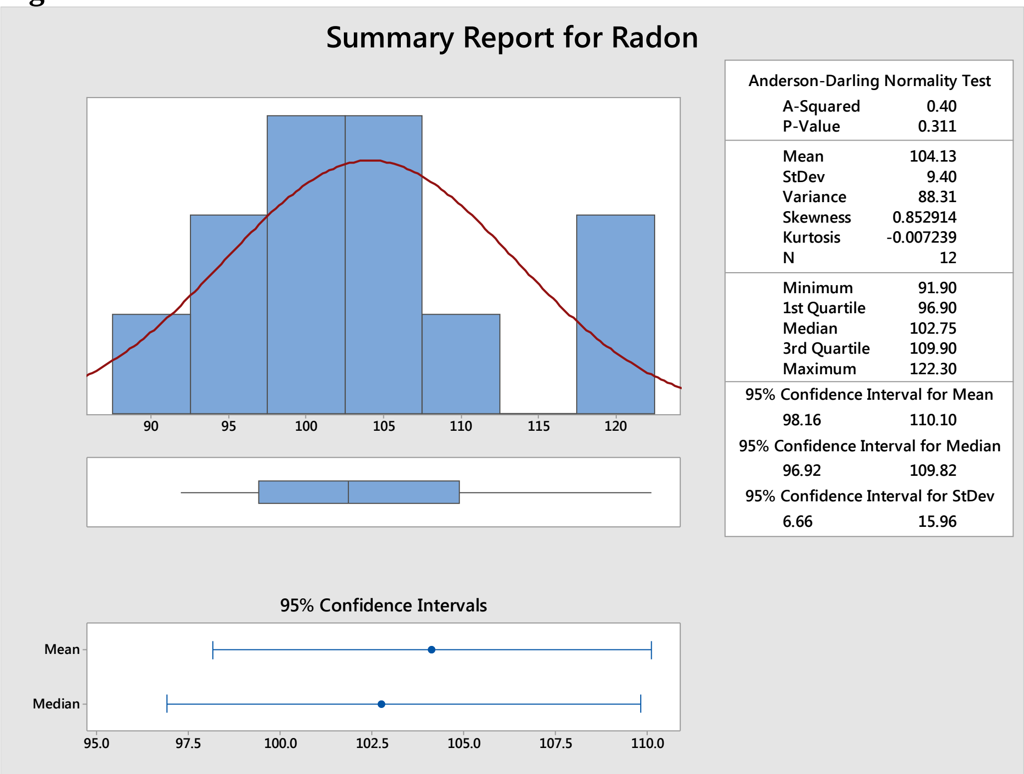

Figure 2.

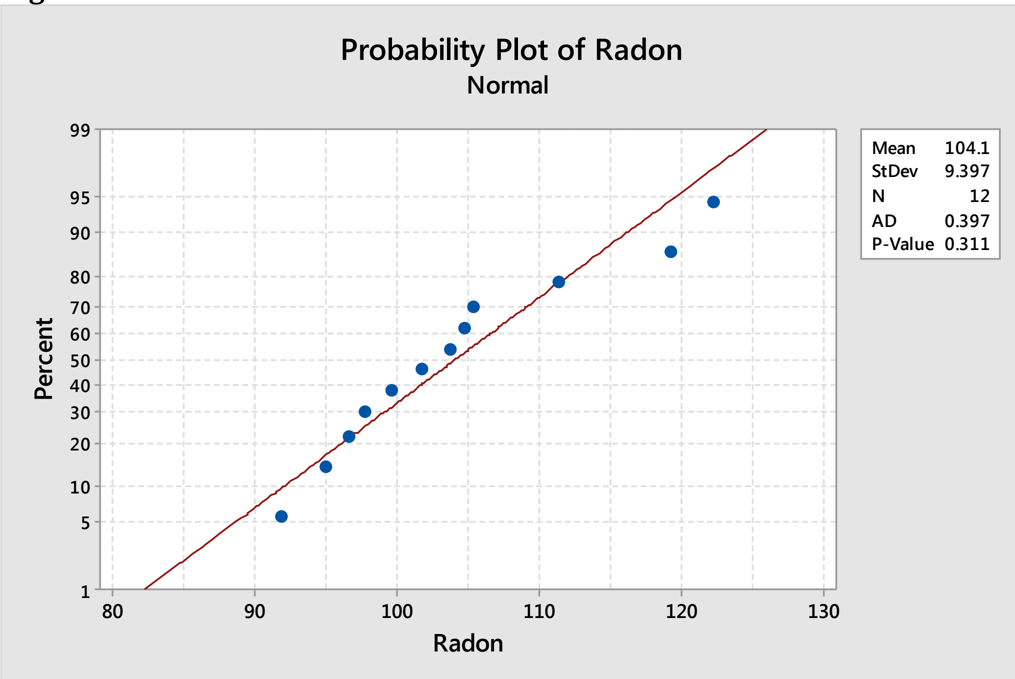

Table 1 : Test and CI for One Variance: Radon

Method

Null hypothesis	σ = 10
Alternative hypothesis	σ ≠ 10

The chi-square method is only for the normal distribution.
The Bonett method is for any continuous distribution.

Statistics

Variable	N	StDev	Variance
Radon	12	9.40	88.3

95% Confidence Intervals

Variable	Method	CI for StDev	CI for Variance
Radon	Chi-Square	(6.66, 15.96)	(44.3, 254.6)
	Bonett	(5.90, 17.89)	(34.8, 320.2)

Tests

Variable	Method	Test Statistic	DF	P-Value
Radon	Chi-Square	9.71	11	0.887
	Bonett	–	–	0.826

2. This question involves (i) Two Independent Samples; (ii) Quantitative Data and (iii) the question is about the variances (i.e. difference in variances of levels of support in villages and towns).

   Both sets are Normally distributed so we can use an F test.

   $H_0 \quad : \quad \sigma_1^2 = \sigma_2^2$ where σ_1^2, σ_2^2 are the population variances in the level of support in villages and towns respectively.

   $H_1 \quad : \quad \sigma_1^2 \neq \sigma_2^2$

   Table 2 shows the results of this two tailed test. Observed Test Statistic F=1.84, df-=17, 10 and p=0.327. This result is also presented in **Figure 8**. p>0.05 i.e. 0.327 so we cannot reject H_o in favour of H_1 at 5% level i.e insufficient evidence that the variances in support in villages and towns are significantly different. We can, therefore, assume that the variances are equal.

Figure 3

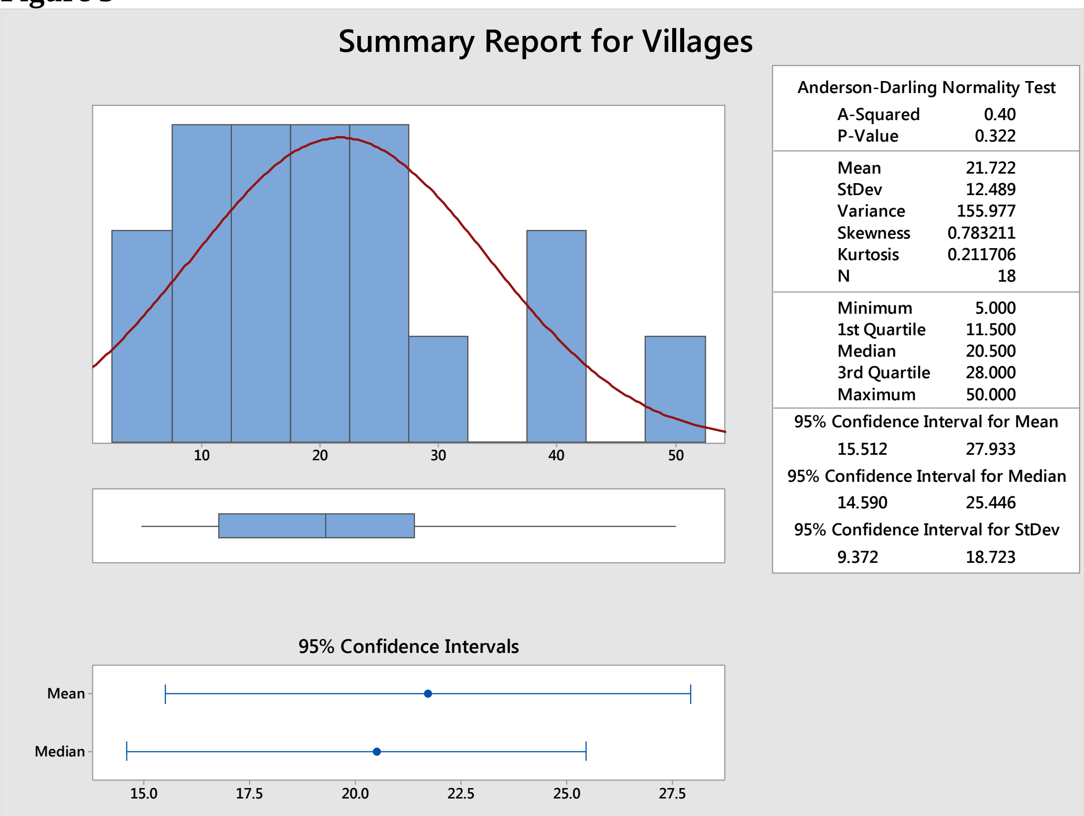

Figure 4

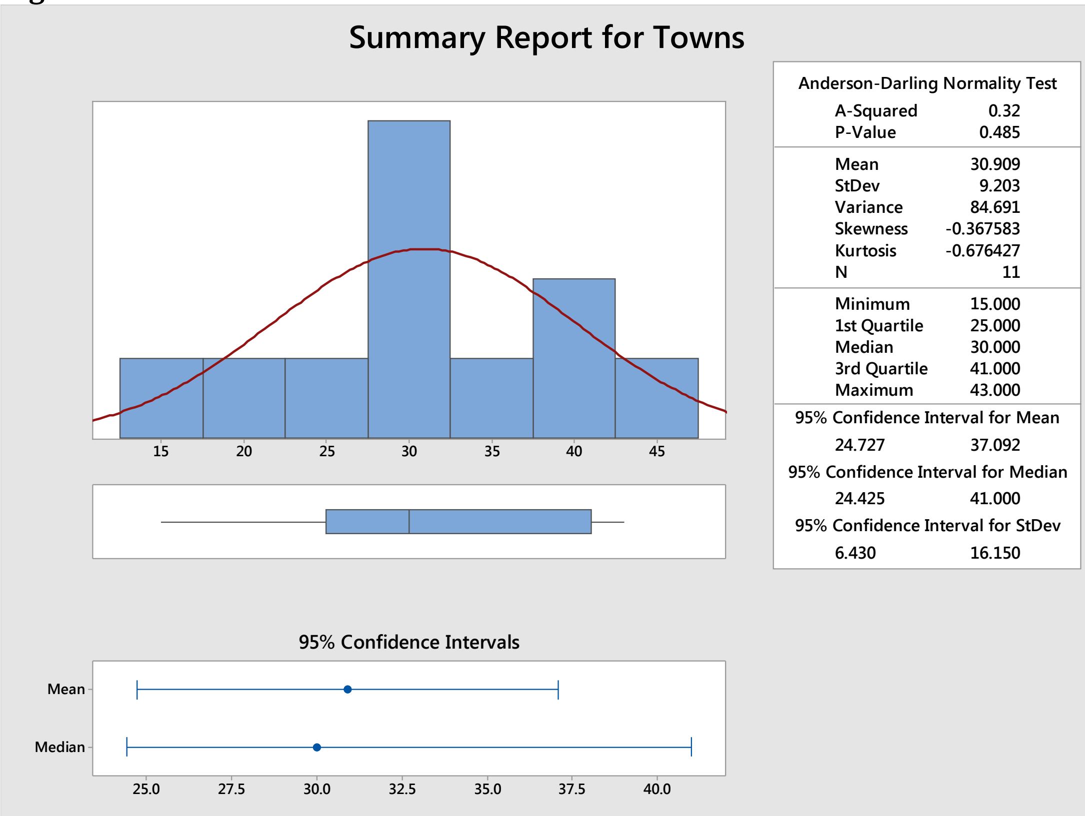

Figure 5.

Figure 6.

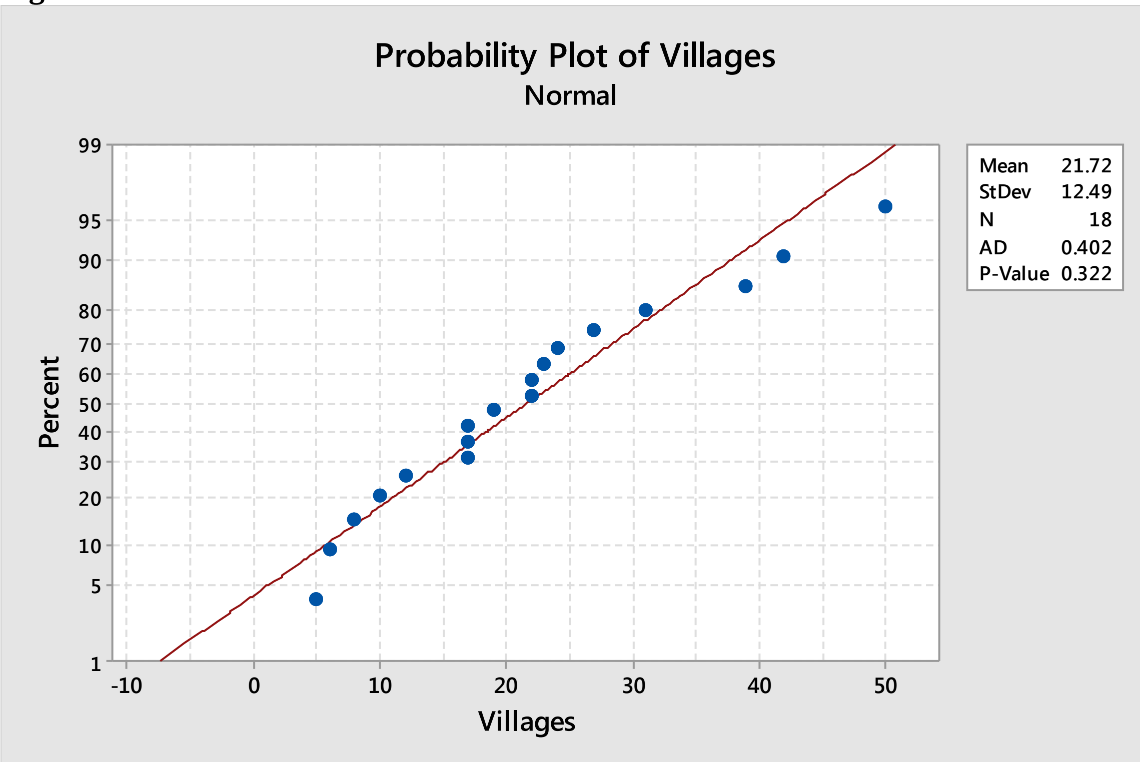

Figure 7.

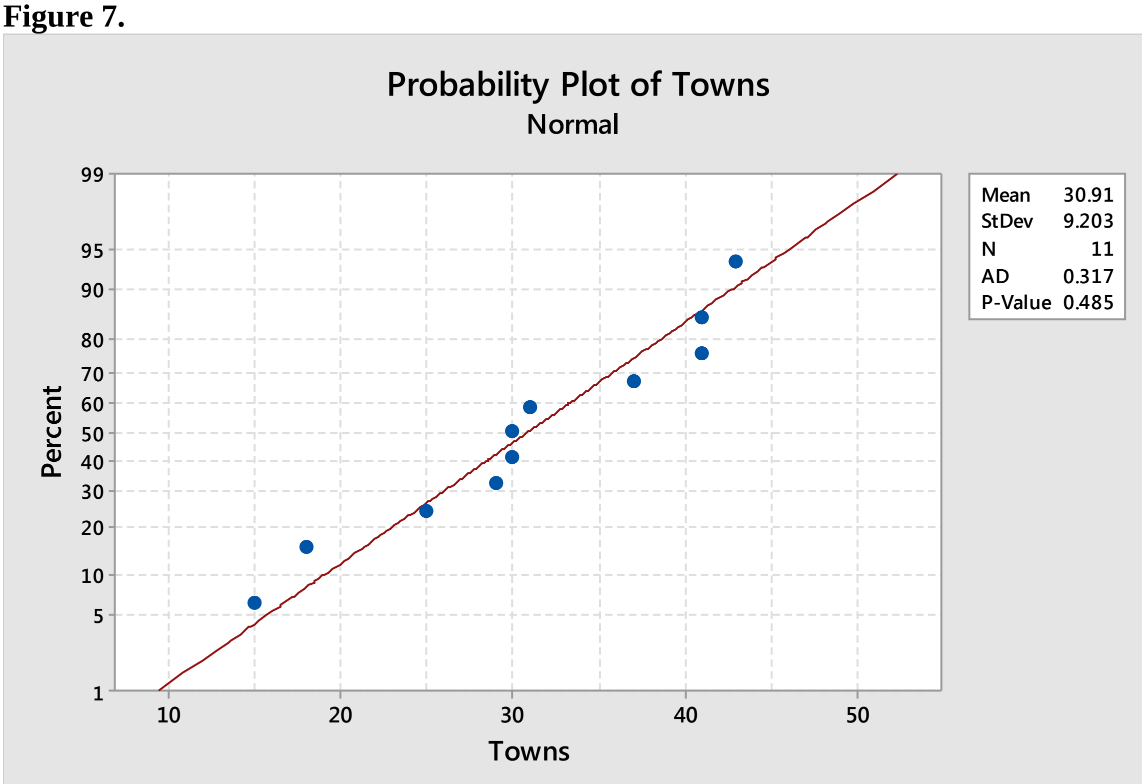

Figure 8.

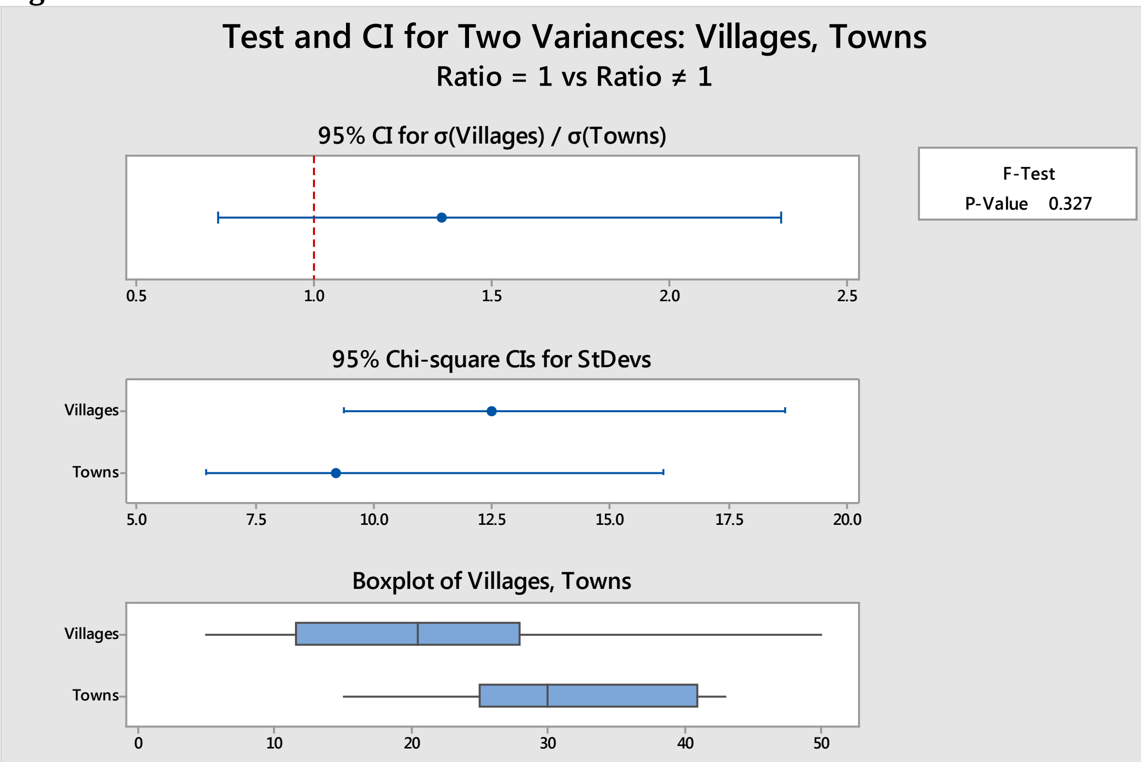

Table 2. Test and CI for Two Variances: Villages, Towns

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Method

Null hypothesis          σ(Villages) / σ(Towns) = 1
Alternative hypothesis   σ(Villages) / σ(Towns) ≠ 1
Significance level       α = 0.05

F method was used. This method is accurate for normal data only.

Statistics
                                   95% CI for
Variable   N   StDev  Variance       StDevs
Villages  18  12.489   155.977  (9.372, 18.723)
Towns     11   9.203    84.691  (6.430, 16.150)

Ratio of standard deviations = 1.357
Ratio of variances = 1.842

95% Confidence Intervals
                            CI for
         CI for StDev      Variance
Method       Ratio           Ratio
F        (0.728, 2.320)  (0.530, 5.382)

Tests
                       Test
Method  DF1  DF2  Statistic  P-Value
F        17   10       1.84    0.327
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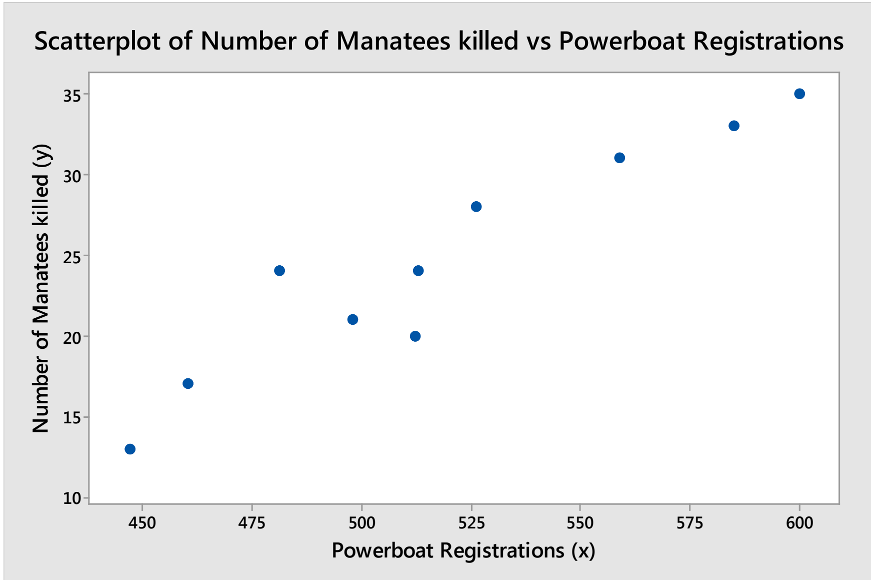
3. **(i)** **Subjective Impression** : Positive linear relationship between number of manatees killed and number of powerboat registrations



(ii) From the Minitab Output below :

Pearson's Product Moment Correlation i.e. the r value = 0.949

Minitab Output for parts (ii)

Correlation: Number of Manatees killed (y), Powerboat Registrations (x)

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Pearson correlation of Number of Manatees killed (y) and Powerboat Registrations (x) = 0.949
P-Value = 0.000
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