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1)A)

Sample Mean Oxygen Level $\bar{y}$ = 8.9

Sample Standard Deviation s = 1.1

Sample Size n = 10 , α = 0.05 (95% confidence level)

t-table value $t_{\alpha/2\,,\,n-1} = t_{0.025,9}$ = 2.262

95% confidence interval for $\mu = \bar{y} \pm \frac{s}{\sqrt{n}} t_{0.025,9}$ $= 8.9 \pm (2.262)(\frac{1.1}{\sqrt{9}}) = 8.9 \pm 0.8294$

= (8.071 , 9.729)

B)

$H_0 : \mu = 8.5$

$H_A : \mu \neq 8.5$

Sample Size n = 10 , α = 0.05 (95% confidence level)

This is a two-tailed distribution. For α=0.05 and two-tailed distribution, t-table value is $t_{\alpha/2\,,\,n-1} = t_{0.025,9}$= 2.262.

Now, Test statistics (TS) $t = \frac{\bar{y} - 8.5}{\frac{s}{\sqrt{n}}} = \frac{8.9 - 8.5}{\frac{1.1}{\sqrt{9}}} = 1.091$

<u>Rejection Region:</u> We can reject null hypothesis H_0 if $|t| > t_{\alpha/2\,,\,n-1}$; or $|t|>2.262$.

Now, $1.091 \ngtr 2.262$, which means the null hypothesis H_0 **can't be rejected**.

<u>Conclusion:</u> Based on the given data, there is not enough evidence to suggest that the true population mean oxygen level is not 8.5 at the 95% confidence level.

C) In order for the confidence interval and hypothesis test to be "valid", the distribution is assumed to be normal. It can be assumed normal if the sample data is not too skewed and / or the sample size n is large.

D) $H_0 : \mu = 8.5$

$H_A : \mu \neq 8.5$

Sample size n = 100, α = 0.05 (95% confidence level)

This is a two-tailed distribution. For α=0.05 and two-tailed distribution, t-table value is $t_{\alpha/2\,,\,n-1} = t_{0.025,99}$= 1.984217.

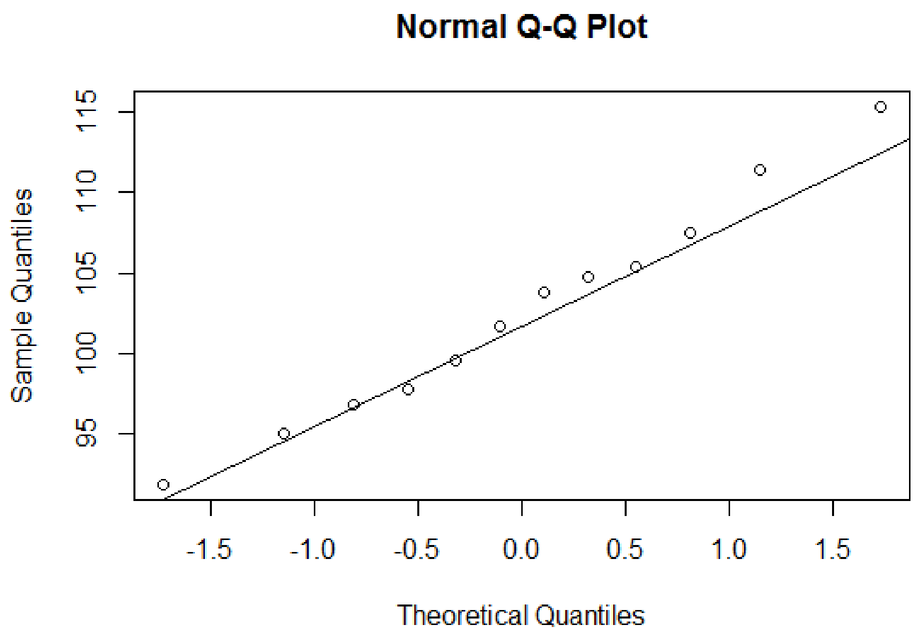
Now, Test statistics (TS) $t = \frac{\bar{y} - 8.5}{\frac{s}{\sqrt{n}}} = \frac{8.9 - 8.5}{\frac{1.1}{\sqrt{100}}} = 3.636$

Rejection Region: We can reject null hypothesis H_0 if $|t| > t_{\alpha/2\,,\,n-1}$; or $|t|>1.984217$.

Now, 3.636 > 1.984217, which means the null hypothesis H_0 **can be rejected**.

Conclusion: Based on the given data, there is enough evidence to suggest with 95% confidence level that the true population mean oxygen level is not 8.5.

2)A.



Shapiro-Wilk normality test

data: HomeRadonDetectData
W = 0.9841, p-value = 0.9951

The QQplot appears to be a straight line. From the Shapiro-Wilk Normality test, we see that p-value is larger than α (0.9951>0.05). So from this we can say that null hypothesis H_0 = data is normally distributed cannot be rejected.

From the QQplot and Shapiro-Wilk test, the data appears to be normally distributed.

2)B)

Sample mean $\bar{y}$ = 102.5833

Sample Standard Deviation s = 6.846344

Sample size n = 12 , α = 0.05 (95% confidence level)

t-table value $t_{\alpha/2\,,\,n-1}= t_{0.025,11}$ = 2.201

95% confidence interval for population mean
$\mu = (\bar{y} \pm \frac{s}{\sqrt{n}} t_{0.025,11})$ = 102.5833 ±(2.201)($\frac{6.846344}{\sqrt{12}}$) = 102.5833 ± 4.3499 = (98.2334 , 106.9332)

C)

$H_0 : \mu = 105$

$H_A : \mu \neq 105$

Sample size n = 12, α = 0.05 (95% confidence level)

This is a two-tailed distribution. For α=0.05 and two-tailed distribution, t-table value is $t_{\alpha/2\,,\,n-1}= t_{0.025,11}=$ 2.201.

Now, Test statistics (TS) t = $\frac{\bar{y}-105}{\frac{s}{\sqrt{n}}} = \frac{102.5833-105}{\frac{6.846344}{\sqrt{12}}} = -1.223$

Corresponding P-value = 0.247

<u>Rejection Region:</u> We can reject null hypothesis H_0 if p-value < α.

Now, $0.247 > \alpha = 0.05$, which means the null hypothesis H_0 **cannot be rejected**.

<u>Conclusion:</u> Based on the given data, there is not enough evidence to suggest with 95% confidence level that the true population mean oxygen level is not 105.

3)A)
$H_0 : \mu \leq 14$

$H_A : \mu > 14$

Sample size n = 300, Sample mean $\bar{y}$ = 14.6, Standard Deviation s = 3.8.

t-table value , $t_{\alpha, n-1} = t_{0.01, 299}$ =2.339

<u>Rejection region:</u> Reject H_0 if test statistic t > $t_{\alpha, n-1,}$

Test statistic t = $= \frac{\bar{y} - 14}{\frac{s}{\sqrt{n}}} = \frac{14.6 - 14}{\frac{3.8}{\sqrt{300}}} = 2.735$

As 2.735 > 2.339, H_0 can be rejected.

Conclusion: Tobacco company's claim of ciggerate nicotine content population mean is 14 mg is not supported by significant evidence and can be rejected with 99% confidence. The agency should take action.

4)A)
Conjectured population standard deviation σ = 2.9

α = 0.05 (95% confidence level)

ME <= 2

Sample size = 11

B)

Conjectured population standard deviation σ = 2.9

α = 0.05 (95% confidence level)

ME <= 1

Sample size = 35

APPENDIX:

R code for Ex. 4:

```
n <- seq(5,50,1)

sd <- 2.9

alpha <- 0.05

ME <- qt(1 - alpha/2 , n-1)*sd/sqrt(n)

ME

out <- data.frame(n,ME)

out
```

Result:

```
    n        ME
1   5 3.6008256
2   6 3.0433634
3   7 2.6820527
4   8 2.4244607
5   9 2.2291373
6  10 2.0745350
7  11 1.9482465
8  12 1.8425721
9  13 1.7524525
10 14 1.6744101
11 15 1.6059665
12 16 1.5453009
13 17 1.4910424
14 18 1.4421361
15 19 1.3977553
16 20 1.3572418
17 21 1.3200642
18 22 1.2857880
19 23 1.2540540
20 24 1.2245626
21 25 1.1970612
22 26 1.1713353
23 27 1.1472018
24 28 1.1245026
25 29 1.1031010
26 30 1.0828778
27 31 1.0637286
28 32 1.0455615
29 33 1.0282953
30 34 1.0118578
31 35 0.9961849
32 36 0.9812188
33 37 0.9669081
34 38 0.9532063
35 39 0.9400713
36 40 0.9274650
```

```
37 41 0.9153529
38 42 0.9037036
39 43 0.8924883
40 44 0.8816806
41 45 0.8712565
42 46 0.8611937
43 47 0.8514719
44 48 0.8420722
45 49 0.8329773
46 50 0.8241709
```