SAMPLING TECHNIQUES (LARGE SAMPLING)

LAB Experiment 4

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Exp - 4

Sampling techniques
Large Sample Test (n>30).
Z-test (One Sample).

Formula :- $z = \dfrac{\bar{x} - \mu}{\sigma/\sqrt{n}} \sim N(0,1)$

Problem-1

Suppose a manufacturer claims that the mean lifetime of a light bulb is more than 10,000 hours. In a sample of 30 light bulbs, it was found that they lasted only 9,900 hours on average. Assume the population standard deviation is 120 hours. At .05 significance level, can we reject the claim by the manufacturer?

The null hypothesis is that $\mu \geq 10000$.

R-code:-

```
>xbar=9900                       #sample mean
>mu0 = 10000                     #hypothesised value.
>sigma = 120                     #population standard deviation.
>n=30                            #sample size.
>z= (xbar-mu0)/(sigma/sqrt(n))
>z                               #test statistic.
 [1] -4.564355
```

Critical Value

We then compute the critical value at 0.05 significance level.

```
>alpha = .05
>z.alpha = qnorm(1-alpha)
>-z.alpha                        #Critical Value
 [1] -1.644854
```

Interpretation

The test statistic -4.5644 is less than the critical value of -1.6449. Hence, at .05 significance level, we reject the claim that mean lifetime of the bulb is above 10,000 hours.

```
> xbar = 9900                                        #Sample mean
> mu0  = 10000                                       #Hypothesized Value
> sigma = 120                                        #population Standard Deviation
> n = 30                                             #Sample Size
> z = (xbar - mu0 )/(sigma/sqrt(n))                  #Test statistic
> z
[1] -4.564355
>
>
> alpha = .05
> z.alpha = qnorm(1- alpha)
> -z.alpha                                          #Critical Value
[1] -1.644854
>
>
> #Interpretation
> #The test statistic -4.5644 is less than the critical value of -1.669. Hence, at .05 significance level, we
 reject tha claim that mean lifetime of the bulbnis above 10,000 hours.
>
```

Upper Tail Test of Population Mean with Known Variance.

The null hypothesis of upper tail test of population mean can be expressed as $\mu \le \mu_0$. Let's define test statistic z in terms of sample size, mean, standard deviation,

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} \sim N(0,1)$$

. Then, Null hypothesis is to be rejected if $z > z_0$.

Problem-2 :-

Suppose the food label on a cookie bag states that there is at most 2 gram of saturated fat in a single cookie. In a sample of 35 cookies it is found that the mean amount of saturated fat per cookie is 2.1 grams. Assume that the population standard deviation is 0.25 grams. At .05 significance level, can we reject the claim on food label?

- The null hypothesis is that $\mu \le 2$. We begin with computing the test statistic.

R-code:-

```
>xbar =2.1                          # sample mean
>mu0= 2                             # hypothesized value.
>sigma=0.25                         # population standard deviation.
>n=35                               #sample size
>z=(xbar-mu0)/(sigma/sqrt(n))
>z                                  # test statistic
[1] 2.366432
```

Critical Value Comparison.

```
>alpha= .05
>z.alpha=qnorm(1-alpha).
>z.alpha                            # Critical Value.
[1] 1.644854
```

Interpretation.

The test statistic 2.3664 is greater than the critical value of 1.6449. Hence, at .05 significance level, we reject that claim that there is at most 2 grams of saturated fat in a cookie.

```
> xbar = 2.1                                          # Sample mean
> mu0 = 2                                             # hypothesized Value
> sigma = 0.25                                        # population standard deviation
> n = 35                                              # Sample Size
>
> z = (xbar - mu0)/(sigma/sqrt(n))                    # test statistic
> z
[1] 2.366432
>
> alpha =.05
> z.alpha = qnorm(1- alpha)
> z.alpha                                             # Critical Value
[1] 1.644854
>
>
> #Intepretation...
> #The test statistic 2.3664 is greater than the critical value of 1.6449. Hence, at .05 significance level,
 we reject that claim that there is at most 2 grams of saturated fat in a cookie.
>
```