Ch7 - Q1 :

Ch7 Q1 :-

Aim to estimate the difference between means of two normal populations with equal but unknown variance.

Let σ_1^2 & σ_2^2 are variance of populations such that $\sigma_1 = \sigma_2 = \sigma$ (unknown)

we have $CI = 100(1-\alpha)\%$

$$95 = 100(1-\alpha)\%$$

$$\alpha = 0.05$$

$$\alpha/2 = 0.025$$

Given $n_1 = 10$ $n_2 = 20$

95% CI of the difference of mean is given by

95% CI of $\mu_2 - \mu_1 =$

$$\bar{x}_2 - \bar{x}_1 \pm t_{\alpha/2,\, n_2+n_1-2}\, S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

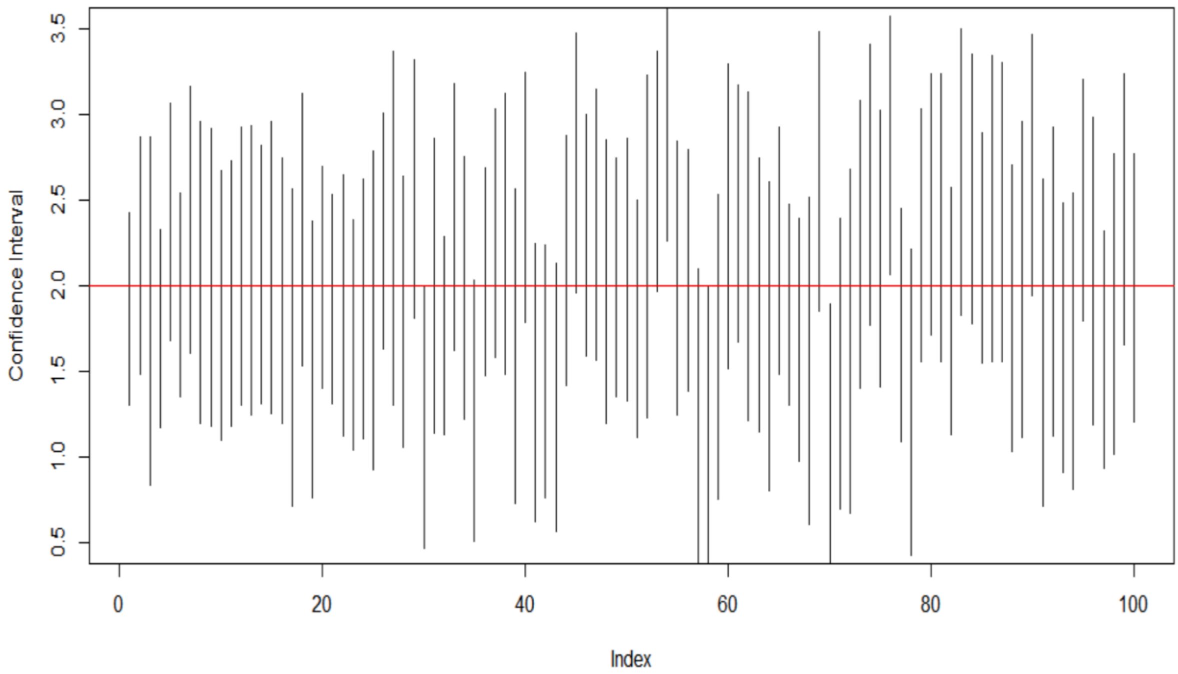
T-value (two-tail) $t_{0.025,28} = 2.048$

R – code :

```
a <- rep(0, 100)
b <- a
c <- qt(0.025, 28, lower.tail = F ) * sqrt(0.15)   # {(1/n1) +(1/n2)} =  0.15
sd_pool  <-  0

for(i in 1:100) {
x <- rnorm(10, 0, 1)
y <- rnorm(20, 2, 1)
sd_pool <- sqrt((9*var(x) + 19*var(y)) / 28)     # n1 + n2 – 2 = 28
a[i] <- mean(y) - mean(x) - c * sd_pool      # lower limit in CI
b[i] <- a[i] + 2 * c * sd_pool}              # upper limit in CI

length(which(a > 2 | b < 2)) / 100
```

output : ***0.05***

```
plot(1 : 100, ylim = c(0.5,3.5), type = "n",  ylab  =  'Confidence Interval')

for( i in 1:100 ) { lines(c(i,i), c(a[i], b[i]))}

abline(2, 0, col = "red")
```



- index <- which(a > 2 | b < 2)
- cbind(a[index], b[index])

output :

```
         [,1]     [,2]
[1,] 0.4664527 1.989436
[2,] 2.2615928 4.029578
[3,] 0.1087425 1.995833
[4,] 0.1017956 1.895198
[5,] 2.0686272 3.574635
```