```r
#Q3

dataQ1 = matrix(NA, nrow=2, ncol=10)
dataQ1[1,] = c(100, 95, 125, 105, 100, 90, 135, 120, 85, 101)
dataQ1[2,] = c(90, 110, 85, 90, 95, 110, 115, 110, 105, 120)
rownames(dataQ1) = c("Goose Bar", "$9 Dinner")
dataQ1

# a
# resposnse: total profits are made in 1 week
# factor: 2 kind of promotionals
# factor levels:
# 1."Goose Bar"
# 2."$9 Dinner"

# b
# treatments: 2     replications: 10
n <- 10

# c
# i
l1 <- dataQ1[1,]
l2 <- dataQ1[2,]
l_total <- c(t1,t2)
mu_hat <- mean(l_total)
mu_hat                                    # mu_hat = 104.3

# ii
tua1 <- mean(l1) - mu.hat
tua1                                      # tua1 = 1.3

# iii
tua2 <- mean(l2) - mu.hat
tua2                                      # tua2 = -1.3
```

```r
# iv
var1 <- var(t1)
var1
var2 <- var(t2)
var2
sigma_sq <- (9 * var1 + 9 * var2) / 18
sigma_sq                                 # sigma.square = 201.24

# d
a <- 0.975
se_tua <- sqrt(sigma_sq * (1/n + 1/n))
se_tua
diff_low <- tua1 - tua2 - qt(a , 2 * n - 2) * se_tua
diff_high <- tua1 - tua2 + qt(a , 2 * n - 2) * se_tua
diff_low                                # diff_low = -10.72867
diff_high                               # diff_high = 15.92867
t.test(l1,l2,var.equal = T)
```

```
	Two Sample t-test

data:  l1 and l2
t = 0.40982, df = 18, p-value = 0.6868
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -10.72867  15.92867
sample estimates:
mean of x mean of y
    105.6     103.0
```

(e)
H0: tua1 – tua2 = 0
Since the confidence interval in (d) include 0 and the p value in more than the a =0.05, there is no evidence to reject the H0. in other wise, in 95% CI, tua1 = tua2

(f)
Basing on the introduction of the question, we don't know the samples are selected randomly or nor, so I don't think this is a reasonable assumption.