Practical – 5: Double Sampling

Q.1) A factory follows a double sampling plan with the following parameters:

- **First sample size: n1=8**
- **Second sample size: n2= 12**
- **Acceptance number for first sample: c1= 1**
- **Acceptance number for combined sample: c2= 4**
- **Defect probability: p=0.07**

Perform the double sampling process and decide whether the lot is accepted or rejected.

```
> set.seed(123)
> n1 = 8
> n2 = 12
> c1 = 1
> c2 = 4
> p =0.07
> N = 100     #Lot size
>
> lot = rbinom(N, 1,p)  #Simulating defectives
> sample1 = sample(lot, n1)
> def1 = sum(sample1)
>
> if (def1 <= c1) {
+   decision = "Accept Lot (after first sample)"
+ } else if (def1 > c1 & def1 <= c2) {
+   sample2 = sample(setdiff(lot, sample1), n2)
+   def2 = sum(sample2)
+   total_def = def1 + def2
+   decision = ifelse(total_def <= c2, "Accept Lot (after second sample)", "Reject Lot")
+ } else {
+     decision = "Reject Lot"
+ }
> print(decision)
[1] "Accept Lot (after first sample)"
```

Q.2) A factory inspects a lot of 120 mobile screens using a double sampling plan to check for defects. In the first stage, a random sample of 12 screens is selected. If 2 or fewer defects are found, the lot is accepted immediately. If more than 6 defects are found, the lot is rejected. However, if the number of defects is between 3 and 6, a second sample of 18 screens is taken. The total number of defects from both samples is then considered. If the total defects are 6 or fewer, the lot is accepted; otherwise, it is rejected. Simulate this process in R, assuming each screen has an 8% probability of being defective.

```
> n1_2 = 12
> n2_2 = 18
> c1_2 = 2
> c2_2 = 6
> p_2 = 0.08
> N_2 = 120
>
> lot_2 = rbinom(N, 1,p)  #Simulating defectives
> sample1_2 = sample(lot, n1_2)
> def1_2 = sum(sample1_2) ;def1_2
[1] 2
>
> if (def1_2 <= c1_2) {
+   decision_2 = "Accept Lot (after first sample)"
+ } else if (def1_2 > c1_2 & def1_2 <= c2_2) {
+   sample2_2 = sample(setdiff(lot_2, sample1_2), n2_2)
+   def2_2 = sum(sample2_2)
+   total_def_2 = def1_2 + def2_2
+   decision_2 = ifelse(total_def_2 <= c2_2, "Accept Lot (after second sample)", "Reject Lot")
+ } else {
+   decision_2 = "Reject Lot"
+ }
> print(decision_2)
[1] "Accept Lot (after first sample)"
```

Q.3) A company inspects a lot of 50 LED bulbs using a double sampling plan to check for defects. In the first stage, a sample of 10 bulbs is tested, with the defect counts given as (0, 1, 0, 0, 1, 0, 1, 1, 0, 0). If 1 or fewer defects are found, the lot is accepted immediately, while if more than 4 defects are found, the lot is rejected. If the number of defects falls between 2 and 4, a second sample of 15 bulbs is tested, with defects recorded as (1, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 1, 0, 0). The total defects from both samples are then considered. If the total defect count is 4 or fewer, the lot is accepted; otherwise, it is rejected. Write an R program to determine whether the lot should be accepted or rejected based on the given defect data.

```
> n1_3 = 10
> n2_3 = 15
> c1_3 = 1
> c2_3 = 4
> N_3 = 50
>
> sample1_3 = c(0, 1, 0, 0, 1, 0, 1, 1, 0, 0)
> def1_3 = sum(sample1_3) ;def1_3
[1] 4
>
> if (def1_3 <= c1_3) {
+   decision_3 = "Accept Lot (after first sample)"
+ } else if (def1_3 > c1_3 & def1_3 <= c2_3) {
+   sample2_3 = c(1, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 1, 0, 0)
+   def2_3 = sum(sample2_3)
+   total_def_3 = def1_3 + def2_3
+   decision_3 = ifelse(total_def_3 <= c2_3, "Accept Lot (after second sample)", "Reject Lot")
+ } else {
+   decision_3 = "Reject Lot"
+ }
> print(decision_3)
[1] "Reject Lot"
```

Q.4) A pharmaceutical company inspects drug tablets using a double sampling plan with defect categories: Minor (weight = 1), Major (weight = 2), and Critical (weight = 5). A first sample of 10 tablets is tested—if the weighted defect score ≤ 3, accept; ≥ 8, reject; 4-7, take a second sample of 15 tablets. The lot is accepted if the total score from both samples ≤ 10, else rejected. Write an R program to determine the lot's acceptance based on given defect data.

```
> # Define sample sizes and acceptance/rejection criteria
> n1 <- 10  # First sample size
> n2 <- 15  # Second sample size
```

```
> c1 <- 3   # Acceptance limit for first sample
> c2 <- 10  # Acceptance limit for both samples combined
>
> # Define defect weights
> defect_weights <- c("Minor" = 1, "Major" = 2, "Critical" = 5)
>
> # First sample defect data
> first_sample <- c("Minor", "Major", "Minor", "Critical", "Minor", "Minor", "Major",
"Minor", "Minor", "Major")
> first_score <- sum(sapply(first_sample, function(x) defect_weights[x]))
>
> # Decision based on first sample
> if (first_score <= c1) {
+   decision <- "Accept Lot (after first sample)"
+ } else if (first_score > c1 & first_score <= c2) {
+   # Second sample defect data
+  second_sample <- c("Minor", "Minor", "Major", "Minor", "Critical", "Major", "Minor",
"Minor", "Major", "Minor", "Minor", "Minor", "Minor", "Major", "Minor")
+   second_score <- sum(sapply(second_sample, function(x) defect_weights[x]))
+   total_score <- first_score + second_score
+   decision <- ifelse(total_score <= c2, "Accept Lot (after second sample)", "Reject Lot")
+ } else {
+   decision <- "Reject Lot"
+ }
>
> print(decision)
[1] "Reject Lot"
```