**Coding Assignment – 5**

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**Code:**

library(Rlab)

# SPRT Function

SPRT <- function(alpha, beta, h0, h1, d, count) {

# alpha = P{Deciding for h1 when h0 is True} = alpha

# beta = P{Deciding for h0 when h1 is True} = beta

num0 = sum(d == 1)

num1 = sum(d == 0)

den0 = sum(d == 1)

den1 = sum(d == 0)

# Calculating lambda

lambda = log(((0.45^num0)\*(0.55^num1))/((0.55^den0)\*(0.45^den1)))

s = lambda

# Calculating a and b values

a = log(beta/(1-alpha))

b = log((1-beta)/alpha)

if(s > b){

#H1 is true and stop

message = "H1 is True"

return\_list = list(s = s, message = message, tf = TRUE, count = count)

return(return\_list)

}

else if(s < a){

#H0 is true and stop

message = "H0 is true"

count = count+1

return\_list = list(s = s, message = message, tf = TRUE, count = count)

return(return\_list)

}

else{

#Collect another observation

message = "Collect another observation"

return\_list = list(s = s, message = message, tf = FALSE, count = count)

return(return\_list)

}

}

# Simulation function

simulation <- function(p, count) {

svector = c()

h0 = 0.45

h1 = 0.55

alpha = 0.01

beta = 0.01

tf = FALSE

count = count

d = rbinom(1, 1, p)

a = log(beta/(1-alpha))

b = log((1-beta)/alpha)

# while loop to iterate through sprt

while(!tf){

return\_list = SPRT(alpha, beta, h0, h1, d, count)

count = return\_list$count

s = return\_list$s

svector = append(svector, s)

message = return\_list$message

tf = return\_list$tf

if(tf == FALSE){

d = append(d, rbinom(1, 1, p))

}

}

# Graph using blue points overlayed by a line

plot(svector, type="o", col="blue")

abline(h=a, col="red")

abline(h=b, col="red")

# Create a title with a red, bold/italic font

pstr = sprintf("%0.2f", p)

title(main=pstr, col.main="red", font.main=4)

ret\_list = list(message = message, count = count)

return(ret\_list)

}

count = 0

# Iterating the simulation 100 times

for(i in 1:100){

#ret\_list = simulation(p = 0.3, count)

#ret\_list = simulation(p = 0.56, count)

ret\_list = simulation(p = 0.54, count)

count = ret\_list$count

cat(ret\_list$message, "\n")

cat("count of H0 being true = ", count, "\n")

}

**Results:**

For p = 0.3

Chart, line chart

Description automatically generated

For p = 0.56

Chart, line chart, scatter chart

Description automatically generated

For p = 0.54

Chart, scatter chart

Description automatically generated

**Observation:**

**Running the test 100 times for every p:**

1. P = 0.3: All 100 times the H1 was True.
2. P = 0.56: All 100 times the H0 was True.
3. P = 0.54: 94 times, H0 was True, 6 times H1 was True.

**Why did it give mixed response for p = 0.54?**

It gave mixed response for p = 0.54 as 0.54 is in the range of our initial hypothesis. Our initial hypothesis was 0.45 and 0.55, so all the values of p between this range will give some mixed response. As we go near 0.55 value more tests will give H0 as True and as we go near 0.45 value more tests will give H1 as True. This is because of the transition. As for all the values above 0.55 will have all the tests give H0 as True and all the values below 0.45 will have all the tests give H1 as True.