Coding Assignment – 5

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Code:

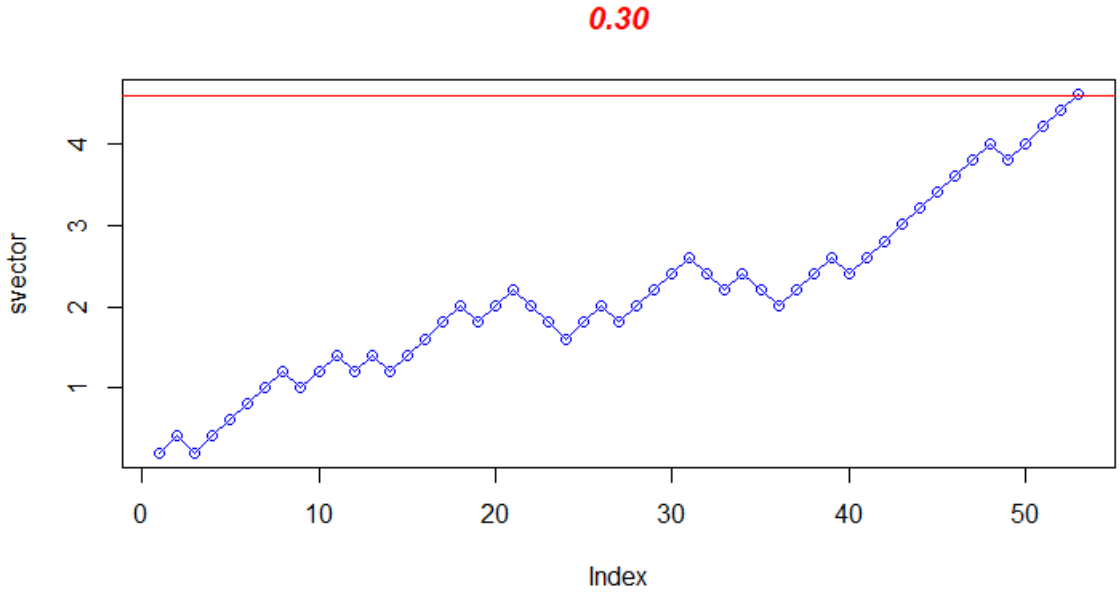
```
library(Rlab)


# 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)
```

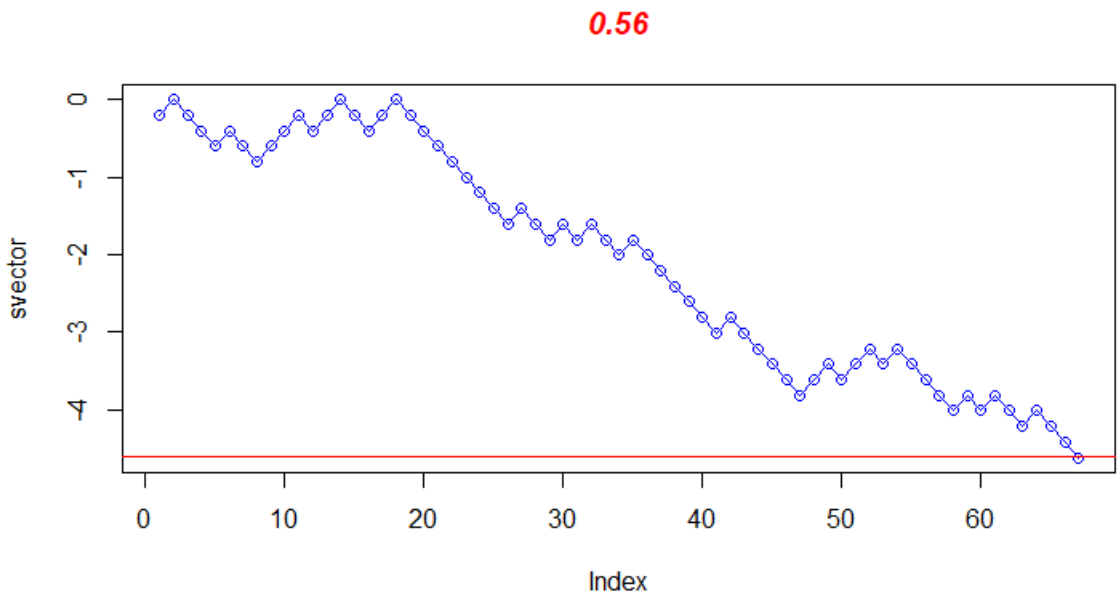
```
    message = return_list$message
    tf = return_list$tf
    if(tf == FALSE){
      d = append(d, rbinom(1, 1, p))
    }
  }
  # Graph using blue points overlayed by a line
  plot(svector, type="o", col="blue")

  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:

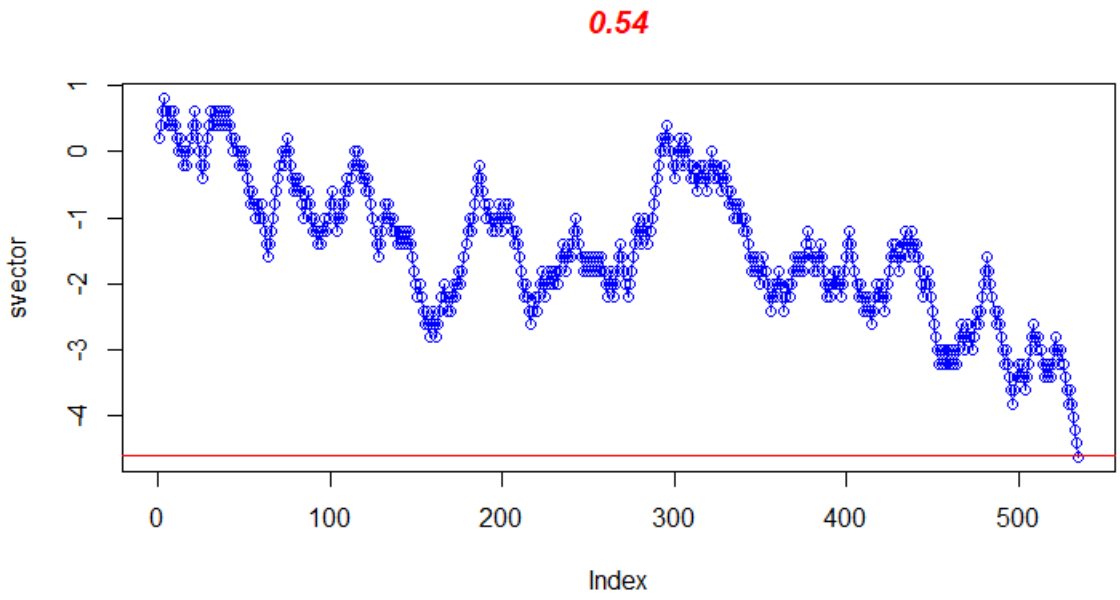
For p = 0.3



For p = 0.56



For p = 0.54



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.