IS 471: Spring 2020

Homework 5

Please write your code in R and submit your script and results for each of the following.

1. Store the following binary number as a character string s: “110011”. (10 points)

library(seqinr)  
library(compositions)  
  
#s <- "110011"  
s <- "111000"  
s

## [1] "111000"

1. Convert this into a character vector v. (10 points)

v <- unlist(strsplit(s, ""))  
v

## [1] "1" "1" "1" "0" "0" "0"

1. Expand the character vector v to 8 bits as follows: swap v[3] and v[4] . (10 points)

swap(v[3], v[4])  
v

## [1] "1" "1" "0" "1" "0" "0"

1. Replicate v[3] and v[4] . The result (call it ev) should be a character vector of size 8. (10 points)

ev <- vector(mode = "character")  
ev[1:4] <- v[1:4]  
ev[5:8] <- v[3:6]  
ev

## [1] "1" "1" "0" "1" "0" "1" "0" "0"

1. Write a function called expand() that takes a binary vector of size 6 as input and returns a binary vector of size 8 as output. (20 points)

expand <- function(v) {  
 ev <- vector(mode = "character")  
 swap(v[3], v[4])  
 ev[1:4] <- v[1:4]  
 ev[5:8] <- v[3:6]  
 return(ev)  
}  
v

## [1] "1" "1" "0" "1" "0" "0"

expand(v)

## [1] "1" "1" "1" "0" "1" "0" "0" "0"

1. Create two character vectors S11 and S12 such that S11 contains the binary representations of the numbers (5,2,1,6,3,4,7,0), and S12 contains those of the numbers (1,4,6,2,0,7,5,3). (10 points)

S11 <- binary(c(5, 2, 1, 6, 3, 4, 7, 0))  
S12 <- binary(c(1, 4, 6, 2, 0, 7, 5, 3))  
S11

## [1] "101" "010" "001" "110" "011" "100" "111" "000"

S12

## [1] "001" "100" "110" "010" "000" "111" "101" "011"

1. Let b=“1101”. Extract the last three characters. Convert the last three characters into decimal and store it in a variable called tempVal. Write an “if-then-else” statement such that if b[1] == 0 retrieve the value of S11[tempval]. If b[1]==1 retrieve the value of S12[tempval] and store it in a variable tempRet. (10 points)

b <- unlist(strsplit("1101", ""))  
b

## [1] "1" "1" "0" "1"

tempVal <- unbinary(paste(b[2:4], collapse = ''))  
tempVal

## [1] 5

tempRet <- ifelse((b[1] == "0"), S11[tempVal + 1], S12[tempVal + 1])  
tempRet

## [1] "111"

1. Write a function called S11\_function that takes a block of 4-character binary (such as “1110”) and, using the two s-boxes from question 6, returns a 3-character binary number using the logic that if the first character is “0” then use S11, otherwise use S12. (20 points)

S11\_function <- function(b) {  
 b <- unlist(strsplit(b, ""))  
 tempVal <- unbinary(paste(b[2:4], collapse = ''))  
 tempRet <- ifelse((b[1] == "0"), S11[tempVal + 1], S12[tempVal + 1])  
 return(tempRet)  
}  
S11\_function("1110")

## [1] "101"