Lab02

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01. LAB02 - Problem#1 - Part 1

```
data = c(2,3,2,6,3,5,6,2,6,6,2,6,6,2,3,6,6,6,5,6,6,5,6,6,6,6,6,4,6,3,3,3,6,6,5,6,6)

dieLoadPrior = c(0.01, 0.99)

dieLoadLL = c(.1,.1,.1,.1,.1,.5)
dieFairLL = c(1/6,1/6,1/6,1/6,1/6,1/6)

dieLoadPost = vector()

titleStr = ""
for (i in 1:length(data)) {
  dieLoadPost[i] = dieLoadPrior[1]

  dnorm = dieLoadPrior[1]*dieLoadLL[data[i]] + dieLoadPrior[2]*dieFairLL[data[i]]

  dieLoadPrior[1] = (dieLoadPrior[1]*dieLoadLL[data[i]])/dnorm
  dieLoadPrior[2] = (dieLoadPrior[2]*dieFairLL[data[i]])/dnorm

  # titleStr = paste(titleStr,data[i], sep="")
  # plot(1:i,dieLoadPost, main = titleStr, ylim = c(0,1), xlim = c(1, length(data)+1))
  # Sys.sleep(.1)
}
```

01. LAB02 - Problem#1 - Part 2

The following average is reported for 50 trials.

```
count = vector()

for (i in 1:50) {
  dieLoadPrior = c(0.01, 0.99)

  dieLoadLL = c(.1,.1,.1,.1,.1,.5)
  dieFairLL = c(1/6,1/6,1/6,1/6,1/6,1/6)

  ct = 0
  while (TRUE) {

    roll = sample(1:6,1,prob= c(.1,.1,.1,.1,.1,.5))
```

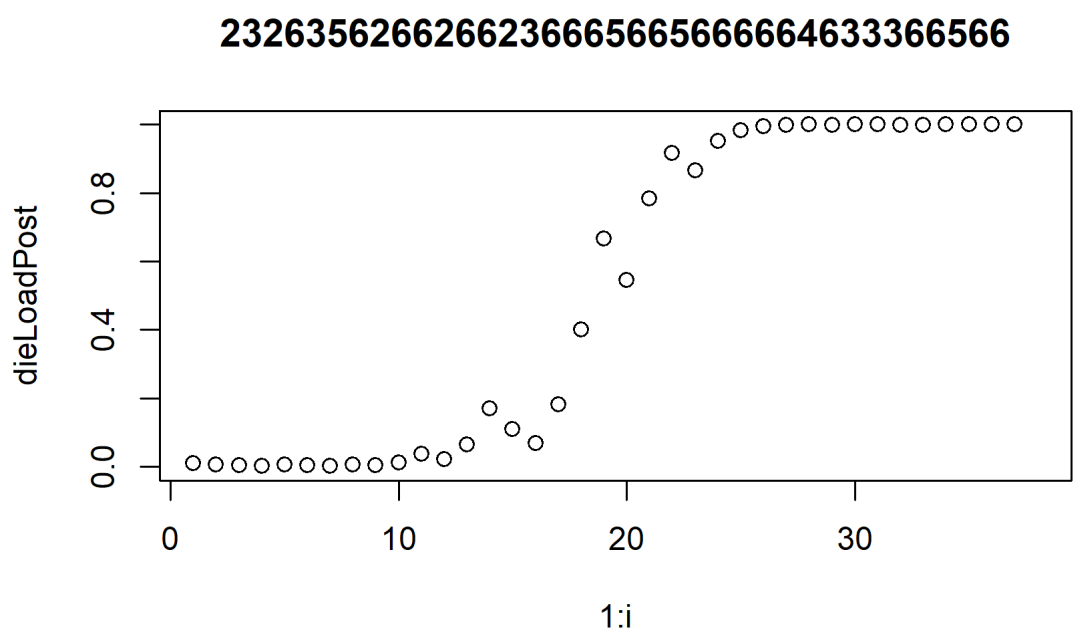

Figure 1: Problem#1, part#1: Plotting the loaded die rolling for the given rolling data

```
    dieLoadPost = dieLoadPrior[1]

    dnorm = dieLoadPrior[1]*dieLoadLL[roll] + dieLoadPrior[2]*dieFairLL[roll]

    dieLoadPrior[1] = (dieLoadPrior[1]*dieLoadLL[roll])/dnorm
    dieLoadPrior[2] = (dieLoadPrior[2]*dieFairLL[roll])/dnorm
    ct = ct + 1
    if (dieLoadPost >= 0.99999){
      count[i] = ct
      break
    }
  }
}

avgTime = ceiling(mean(count))
print(paste('On avg we have to roll the loaded die',avgTime,'times'))
```

```
## [1] "On avg we have to roll the loaded die 59 times"
```

01. LAB02 - Problem#2 - Part 1

For patient with the disease, the test has to be run for getting positive result. In this scenerio, we can have two case types: 1. p(Positive|Person has disease) 2. p(Negative|Person has disease). The following average is reported for 50 trials.

```
count = vector()
```

```
for (i in 1:50) {
  ptPosPrior = c(0.001, 0.999)

  posPtPosLL = c(.91,0.09)
  posPtNegLL = c(0.16,0.84)

  ct = 0
  while (TRUE) {

    roll = sample(1:2,1,prob= c(.91,0.09))
    ptPosPost = ptPosPrior[1]

    dnorm = ptPosPrior[1]*posPtPosLL[roll] + ptPosPrior[2]*posPtNegLL[roll]

    ptPosPrior[1] = (ptPosPrior[1]*posPtPosLL[roll])/dnorm
    ptPosPrior[2] = (ptPosPrior[2]*posPtNegLL[roll])/dnorm
    ct = ct + 1
    if (ptPosPost >= 0.99999){
      count[i] = ct
      break
    }
  }
}

avgTime = ceiling(mean(count))
cat('For a patient with the disease,\non avg the test needs to be repeated',avgTime,'times')
```

```
## For a patient with the disease,
## on avg the test needs to be repeated 15 times
```

01. LAB02 - Problem#2 - Part 2

For patient without the disease, the test has to be run for getting negative result. In this scenerio, we can have two case types: 1. p(Positive|Person doesn't have disease) 2. p(Negative|Person doesn't have disease). The following average is reported for 50 trials.

```
count = vector()

for (i in 1:50) {
  ptPosPrior = c(0.001, 0.999)

  posPtPosLL = c(.91,0.09)
  posPtNegLL = c(0.16,0.84)

  ct = 0
  while (TRUE) {

    roll = sample(1:2,1,prob= c(0.16,0.84))
    ptPosPost = ptPosPrior[2]

    dnorm = ptPosPrior[1]*posPtPosLL[roll] + ptPosPrior[2]*posPtNegLL[roll]

    ptPosPrior[1] = (ptPosPrior[1]*posPtPosLL[roll])/dnorm
    ptPosPrior[2] = (ptPosPrior[2]*posPtNegLL[roll])/dnorm
```

```
    ct = ct + 1
    if (ptPosPost >= 0.99999){
      count[i] = ct
      break
    }
  }
}

avgTime = ceiling(mean(count))
cat('For a patient without the disease,\non avg the test needs to be repeated',avgTime,'times')
```

```
## For a patient without the disease,
## on avg the test needs to be repeated 5 times
```

01. LAB02 - Problem#2 - Part 3

The hospital plans to run the test on one million (1M) patients per year. They have a diagnostic test for the disease with a known background prevalence of 0.1%.

Therefore, 0.1% of 1M = 1000 persons may have the disease. Similarly, 99.9% of 1M = 999,000 persons may not have the disease.

From, part#2 we learn, it takes on avg 15 repeated test to achieve hospital requirement if the person has disease and it takes on avg 5 test if the person doesn't have the disease.

Therefore, total number of tests required for 1M patients are: = (1000 x 15) + (999,000 x 5) = 5,010,000 = 5M test (approx.)

Since, each test cost $1, the hospital budget should be around $5M.