

# Pi Space Matrix

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## Summary

Jonas von Essen divides 100 digits into 11 blocks. The first 10 blocks has length of 9 digits and the last block has length of 10 digits. This is his way of dividing the first 100,000 digits of Pi into blocks. We want to calculate when the first collision appears in Pi in this division. This has been done in the program R by loading the first million digits of Pi. We can see that there are no collisions in the first 100,000 digits. As matter of fact the first collision is 460781818 and it appears at digit number 383,019 and 469,555.

## The R Code

```
# Import the first million digits of Pi
# Reading the data
p = read.table("C:\\Users\\Mark\\Desktop\\million.txt",
  header = TRUE )
# Splitting data into lines
text = readLines ("C:\\Users\\Mark\\Desktop\\million.txt"
, encoding =" UTF -8")
v=c(strsplit(text , "") [[1]])
# Converting string into integer
strtoi(v,base = 10)

# Define the subsets Jonas uses.

# This proces has to be done 1000 times
u=matrix(,byrow=TRUE,ncol=10)
for(n in seq(0,1000000,by=100) ) {
u=rbind(u,      rbind(
      cbind( matrix( v[(1+n) : (90+n)],ncol=9      ,
      byrow=TRUE),NA)
      , v[(91+n) : (100+n)]
    )
  )
}
head(u) # We see that 'u' is the right matrix.

## Check for duplicated block for the first 10,000
entries
## Ie the first 100,000 digits.
u[duplicated(u[1:10000,]),]
# Empty, ie there are no duplicated blocks.

## Check for duplicated block for the first 100,000
entries
```

```

## Ie the first million digits.
u[duplicated(u[1:100000,]),]
# This gives us 5 blocks. We will look at the first
  block only.
# This block is 460781818.

# Find the entry of block 460781818.
which(duplicated(u)==TRUE)
# Gives us 51653. Now let's find the entry of both
  duplicated blocks.

y=c()
for(j in 1:51653){
if(identical(as.character(u[j,]) ,
  as.character(u[51653,]))) {y[j]=1}
else{y[j]=0}
}
which(y==1)
# 42134, 51653. These are the entries.

u[42134,]
u[51653,]
# Both gives the block 460781818 as they should do.

# The exact location in Pi is at digit number
library(stringr)
str_locate_all(text,"460781818")
# Result: 383019 and 469555.

```