

# minimum.R

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```
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# CS320 Honors Option
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# Minimum() in a binomial heap should be  $O(\log n)$ 

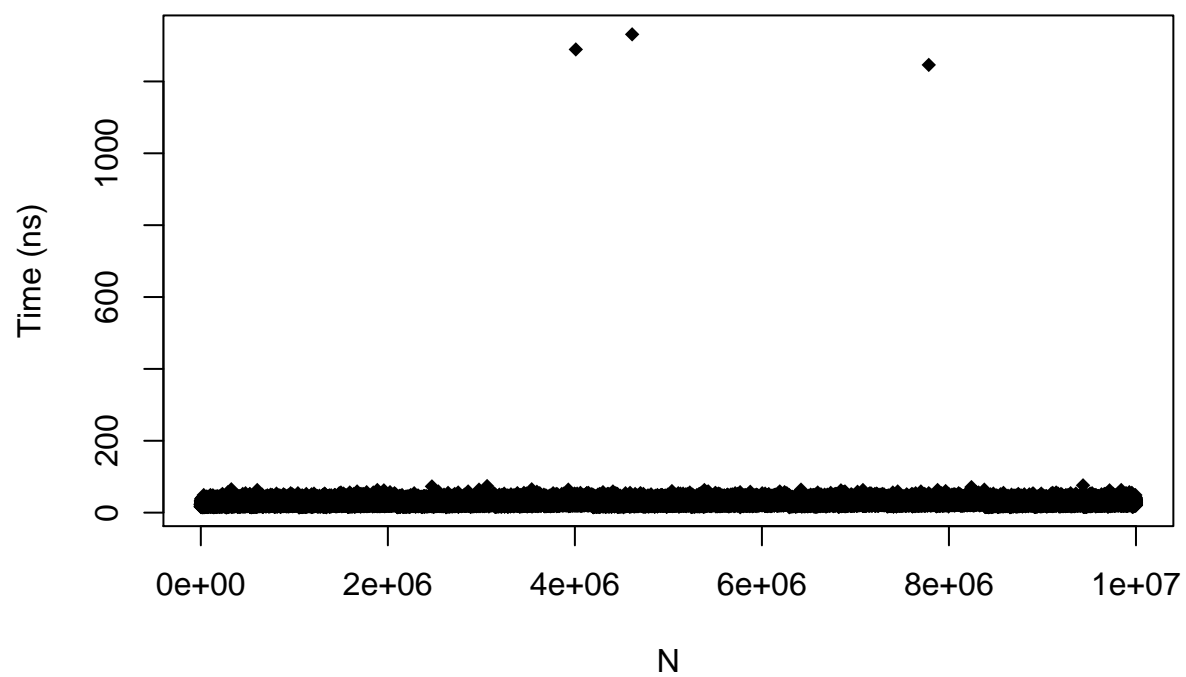
minimum_binomial = read.csv("./minimum_binomial.csv")
attach(minimum_binomial)

## The following object is masked from package:base:
##
##      T
summary(T)

##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##      15.00   25.00   28.00   29.01   33.00  1331.00

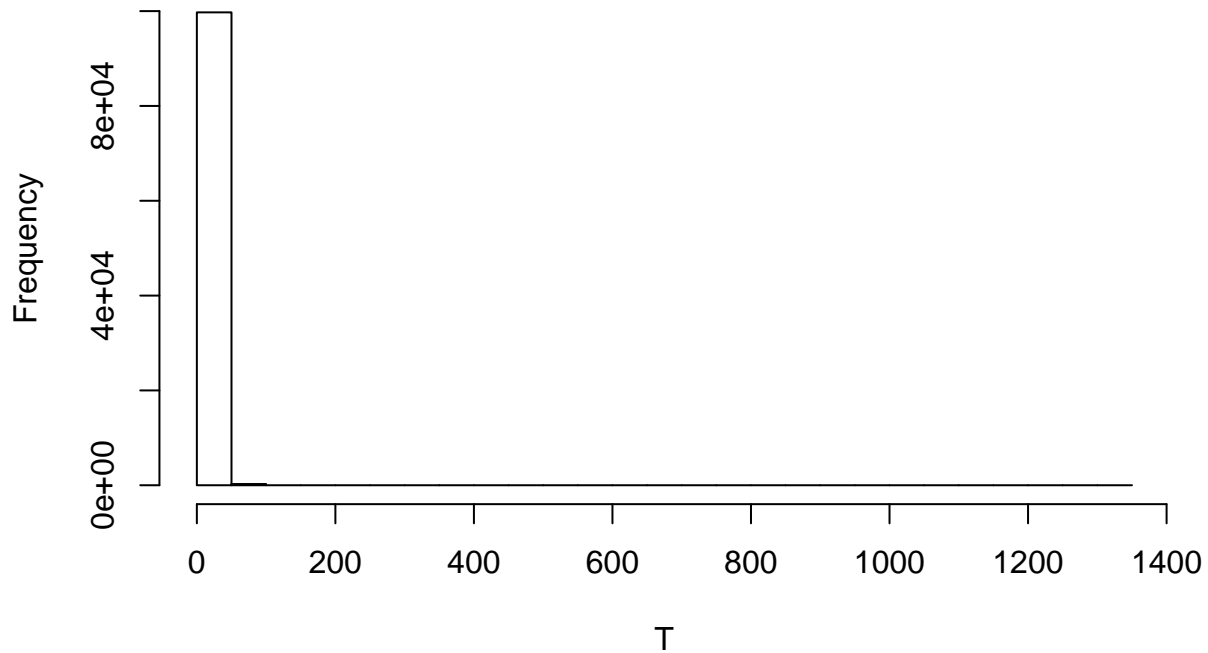
# min 15
# q1 25
# median 28
# mean 29.01
# q3 33
# max 1331
plot(N,T,pch=18,xlab="N",ylab="Time (ns)",main="Binomial_Heap.Minimum()")
```

## Binomial\_Heap.Minimum()



```
hist(T,breaks=20)
```

## Histogram of T



```
# Let's try to remove the outliers. Most times fall below 100 ns
```

```
sum(T>100) # there are 3 outliers.
```

```
## [1] 3
```

```
T[which(T>100)] # the are 1289, 1331, and 1246
```

```
## [1] 1289 1331 1246
```

```
# Let's remove the outliers and try again
```

```
summary(T[which(T<100)])
```

```
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  15.00   25.00   28.00  28.97   33.00   76.00
```

```
# min 15
```

```
# q1 25
```

```
# median 28
```

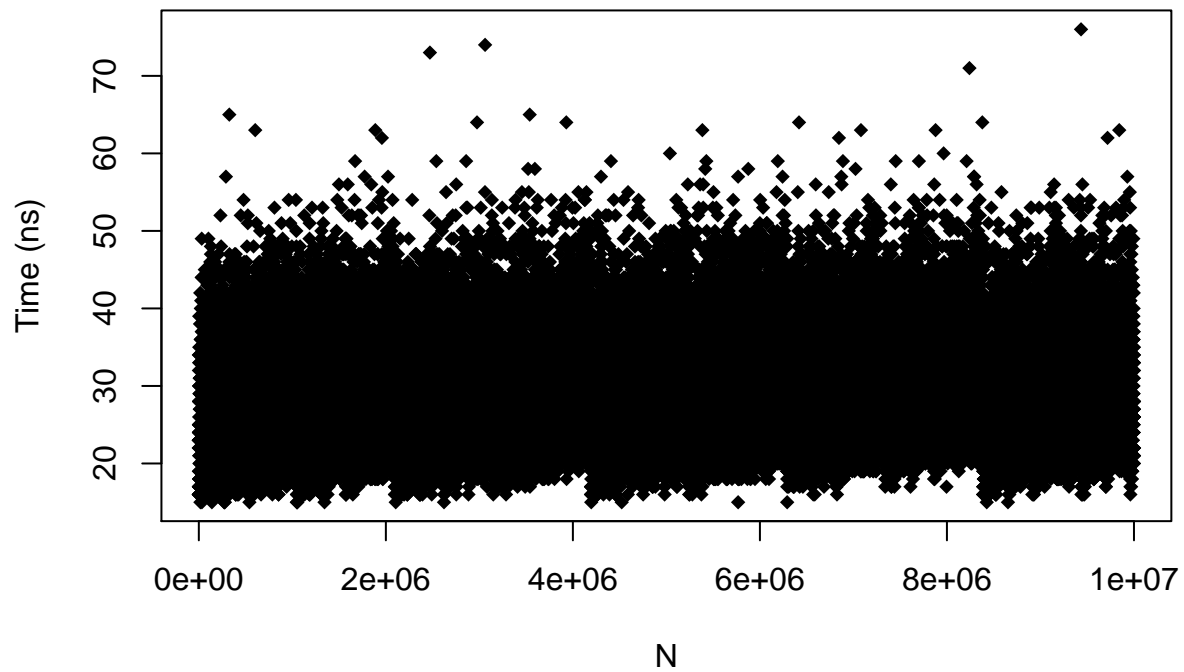
```
# mean 28.97
```

```
# q3 33
```

```
# max 76
```

```
plot(N[which(T<100)],T[which(T<100)],pch=18,xlab="N",ylab="Time (ns)",main="Binomial_Heap.Minimum() E
```

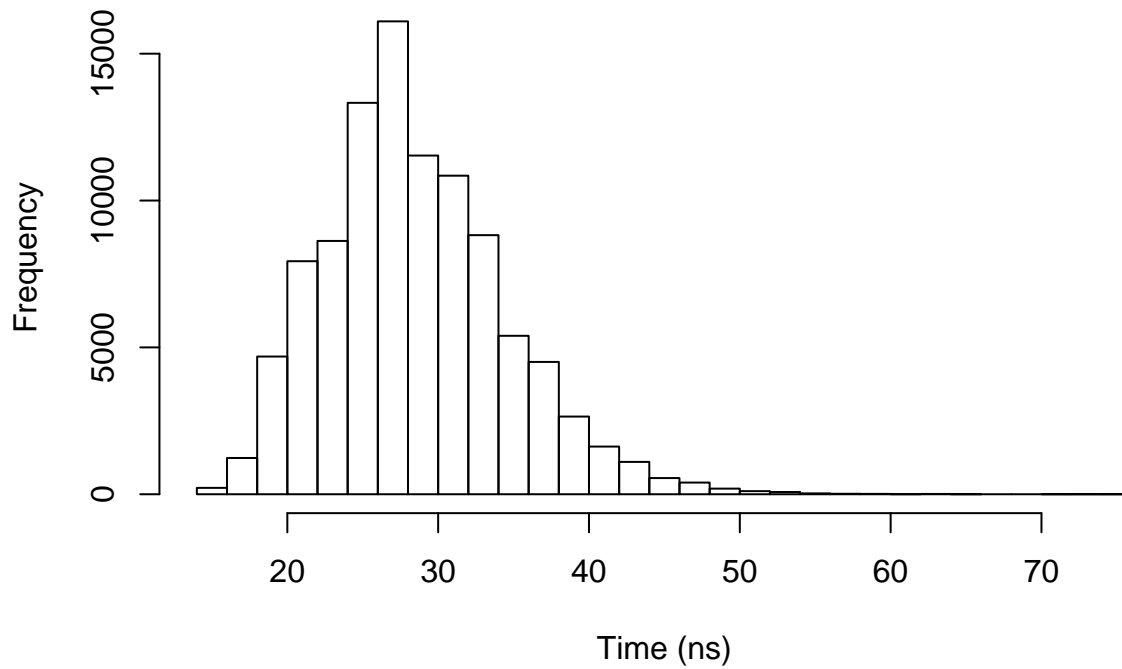
## Binomial\_Heap.Minimum() Excluding Outliers



*# Better, but not a very useful representation of the data*

```
hist(T[which(T<100)],main="Histogram of Time Excluding Outliers",xlab="Time (ns)",breaks=30)
```

## Histogram of Time Excluding Outliers



*# Looks like most calls to minimum() take under 100 ns.  
# There also doesn't appear to be a large correlation between T and N  
# The implementation must be correct for an  $O(\log n)$  time.*

```
detach(minimum_binomial)
```