

# extract\_min.R

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```
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# CS320 Honors Option
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# Extract_Min() Should be  $O(\log n)$ 

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

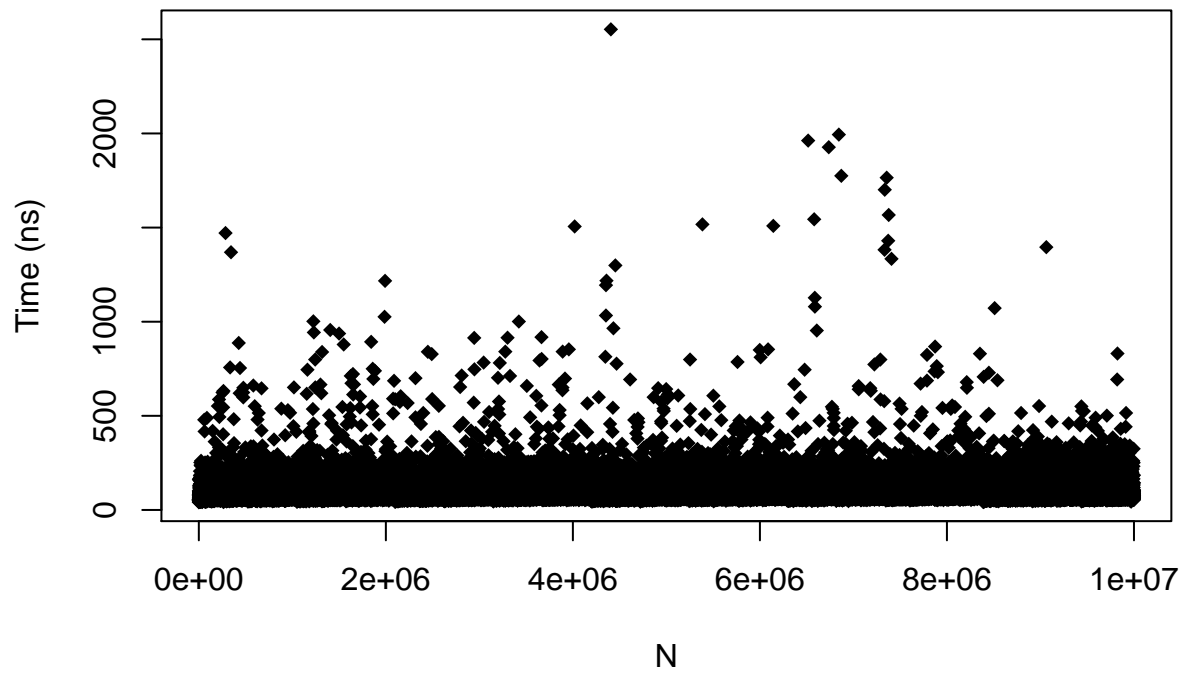
## The following object is masked from package:base:
##
##      T
summary(T)

##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##      41.0    71.0    84.0    96.5   107.0  2553.0

# min 41
# q1 71
# median 84
# mean 96.5
# q3 107
# max 2553

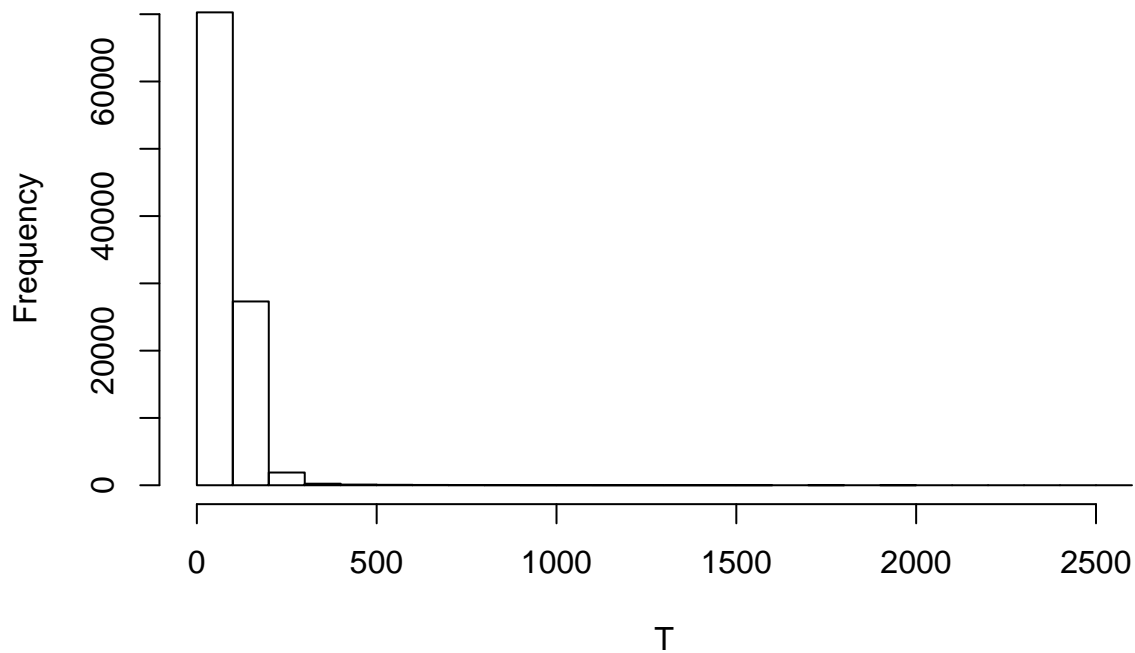
plot(N,T,pch=18,xlab="N",ylab="Time (ns)",main="Binomial Heap.Extract_Min()")
```

## Binomial Heap.Extract\_Min()



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

## Histogram of T



```
# Let's see if we can remove some outliers
```

```
quantile(T,seq(0,1,0.1))
```

```
##    0%   10%   20%   30%   40%   50%   60%   70%   80%   90%  100%
##    41    63    69    74    79    84    91   100   116   142  2553
```

```
quantile(T,seq(0.9,1,0.01))
```

```
##   90%   91%   92%   93%   94%   95%   96%   97%   98%   99%  100%
##  142  145  150  155  161  169  179  191  209  247  2553
```

```
# Let's separate the top 1% and analyze
```

```
# Top 1%
```

```
summary(T[which(T>247)])
```

```
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   248.0  269.0   306.0   401.7  441.0  2553.0
```

```
# min 248
```

```
# q1 269
```

```
# median 306
```

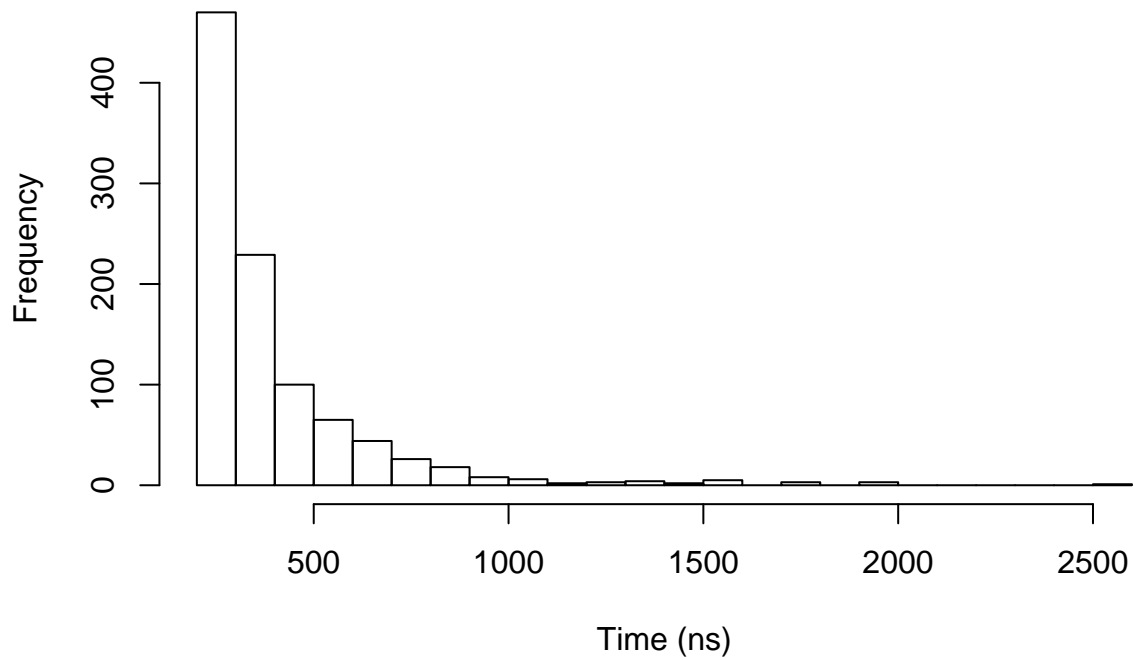
```
# mean 401.7
```

```
# q3 441
```

```
# max 2553
```

```
hist(T[which(T>247)],main="Histogram of Top 1% of Times",xlab="Time (ns)",breaks=20)
```

## Histogram of Top 1% of Times



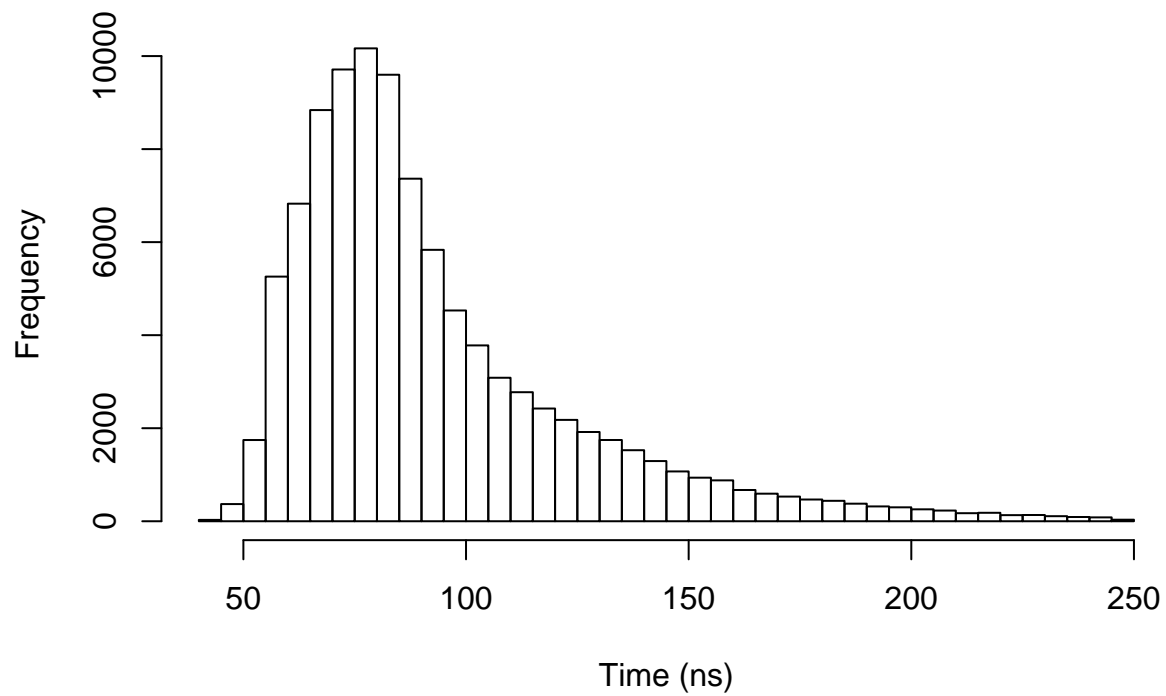
```
# Bottom 99%  
summary(T[which(T<=247)])
```

```
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.   
##    41.00  71.00   84.00   93.45 106.00  247.00
```

```
# min 41  
# q1 71  
# median 84  
# mean 93.45  
# q3 106  
# max 247
```

```
hist(T[which(T<=247)],main="Histogram of Bottom 99% of Times",xlab="Time (ns)",breaks=30)
```

### Histogram of Bottom 99% of Times



*# 99% of calls take less than 247 ns.  
# There also doesn't appear to be a large correlation between  $N$  and  $T$ .  
# The implementation must be correct for an  $O(\log n)$  time.*

```
detach(extract_min_binomial)
```