Chapter 12: Summarizing Measured Data

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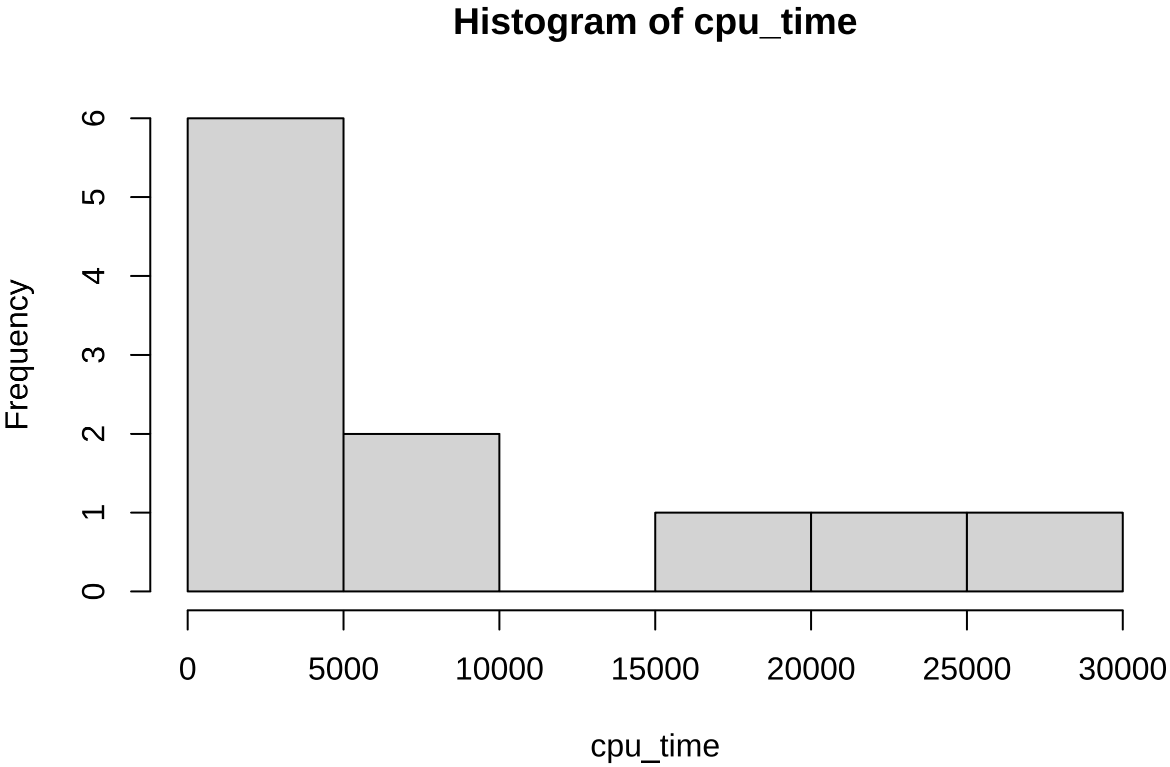
Exercises

12.10 The CPU times in milliseconds for 11 workloads on a processor are 0.74, 0.43, 0.24, 2.24, 262.08, 8960, 4720, 19740, 7360, 22,440, and 28,560. Which index of central tendency would you choose and why?

```
cpu_time <- c(0.74, 0.43, 0.24, 2.24, 262.08, 8960, 4720, 19740, 7360, 22440, 28560)
hist(cpu_time)
```



The histogram above shows the distribution of the measured CPU time. We can see a positive skew.

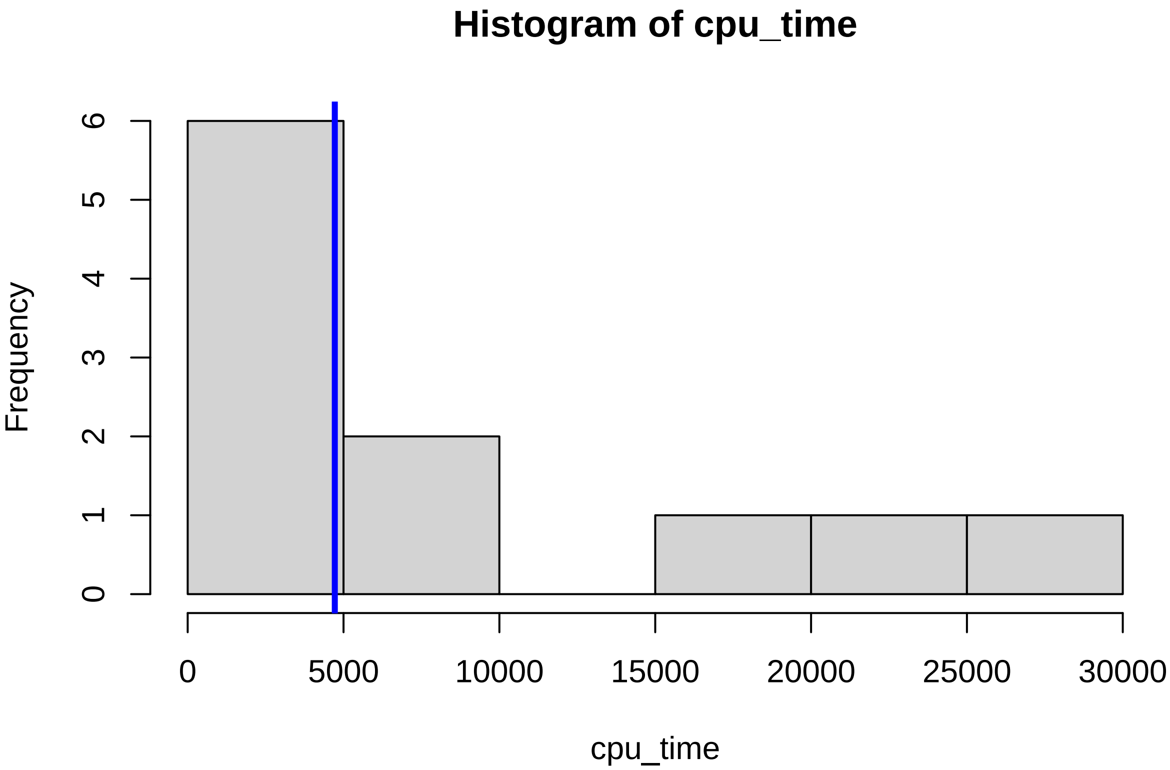
> If the histogram is skewed, the median is more representative of a typical observation than the mean.

So median is chosen.

```
paste("Median = ", median(cpu_time))
```

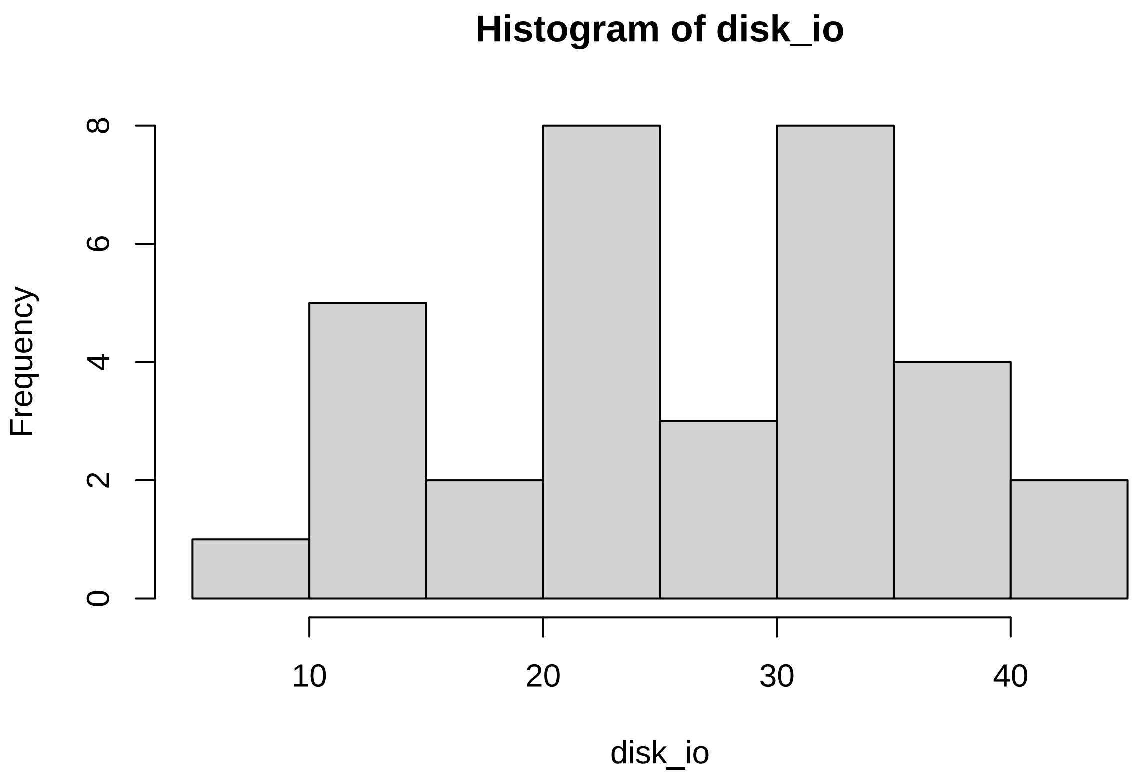
```
## [1] "Median =  4720"
```

```
hist(cpu_time)
abline(v = median(cpu_time), col = "blue", lwd = 3)
```



12.11 The number of disk I/O's performed by a number of programs were measured as follows: {23, 33, 14, 15, 42, 28, 33, 45, 23, 34, 39, 21, 36, 23, 34, 36, 25, 9, 11, 19, 35, 24, 31, 29, 16, 23, 34, 24, 38, 15, 13, 35, 28}. Which index of central tendency would you choose and why?

```r
disk_io <- c(23, 33, 14, 15, 42, 28, 33, 45, 23, 34, 39, 21, 36, 23, 34, 36, 25, 9, 11, 19, 35, 24, 31,
hist(disk_io)
```

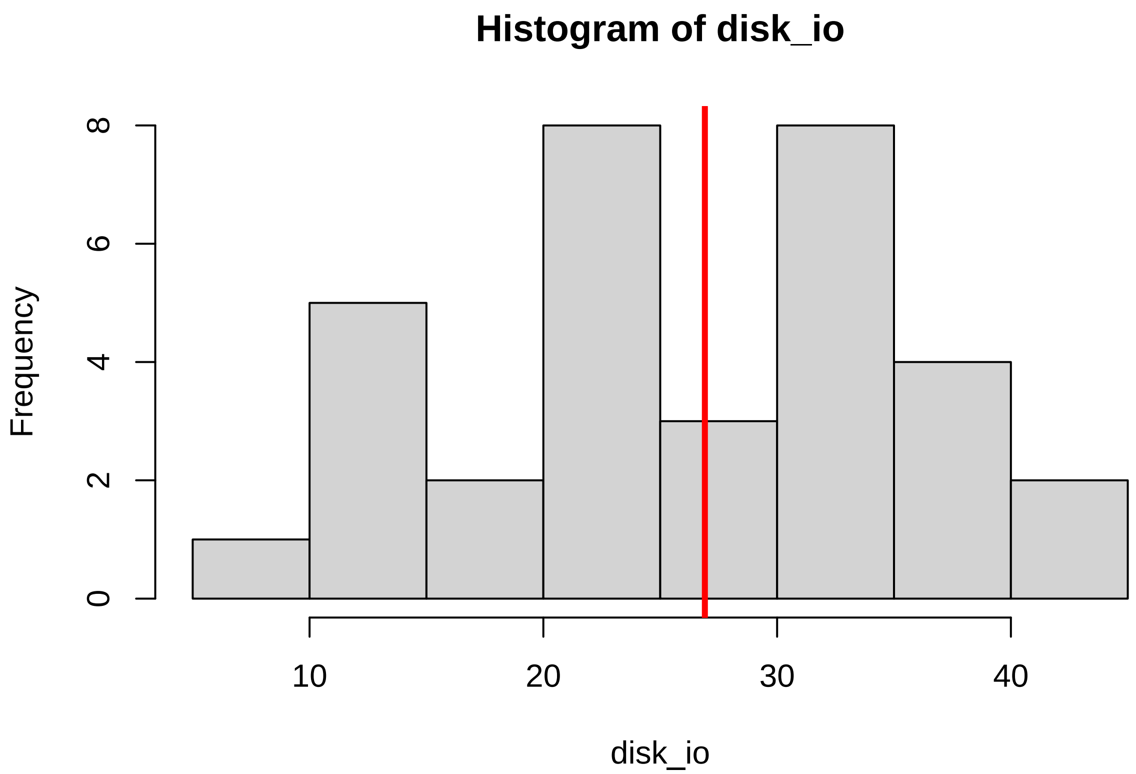


Distribution is not so skewed so mean is chosen as central tendency index

```
paste("Mean = ", mean(disk_io))
```

```
## [1] "Mean =  26.9090909090909"
```

```
hist(disk_io)
abline(v = mean(disk_io), col = "red", lwd = 3)
```



12.13 For the data of Exercise 12.10, which index of dispersion would you choose and why?

Semi-interquantile range. For the same reason the median was chosen as index of central tendency. The distribution of the data has a positive skewed.

```
paste("Semi-interquantile range = ", IQR(cpu_time)/2)
```

```
## [1] "Semi-interquantile range =  7174.255"
```

12.14 For the data of Exercise 12.11, compute all possible indices of dispersion. Which index would you choose and why?

```
paste("Range = ", range(disk_io))
```

```
## [1] "Range =  9"  "Range =  45"
```

```
paste("Standard deviation = ", sd(disk_io))
```

```
## [1] "Standard deviation =  9.49461569905424"
```

```
paste("C.O.V. = ", sd(disk_io) / mean(disk_io) * 100)
```

```
## [1] "C.O.V. =  35.2840448275664"
```

```
paste("Semi-interquantile range = ", IQR(disk_io)/2)
```

```
## [1] "Semi-interquantile range =  6.5"
```

The data is not bounded, so a range doesn't make sense. The distribution is symmetrical, so there is no need for SIQR. Finally, I would choose standard deviation as index of dispersion.

13.2 **Answer the following for the data of Exercise 12.11:**

a. What is the 10-percentile and 90-percentile from the sample?

R quantile algorithm types: 10 observations, {0 1 1 1 2 2 2 4 5 8}

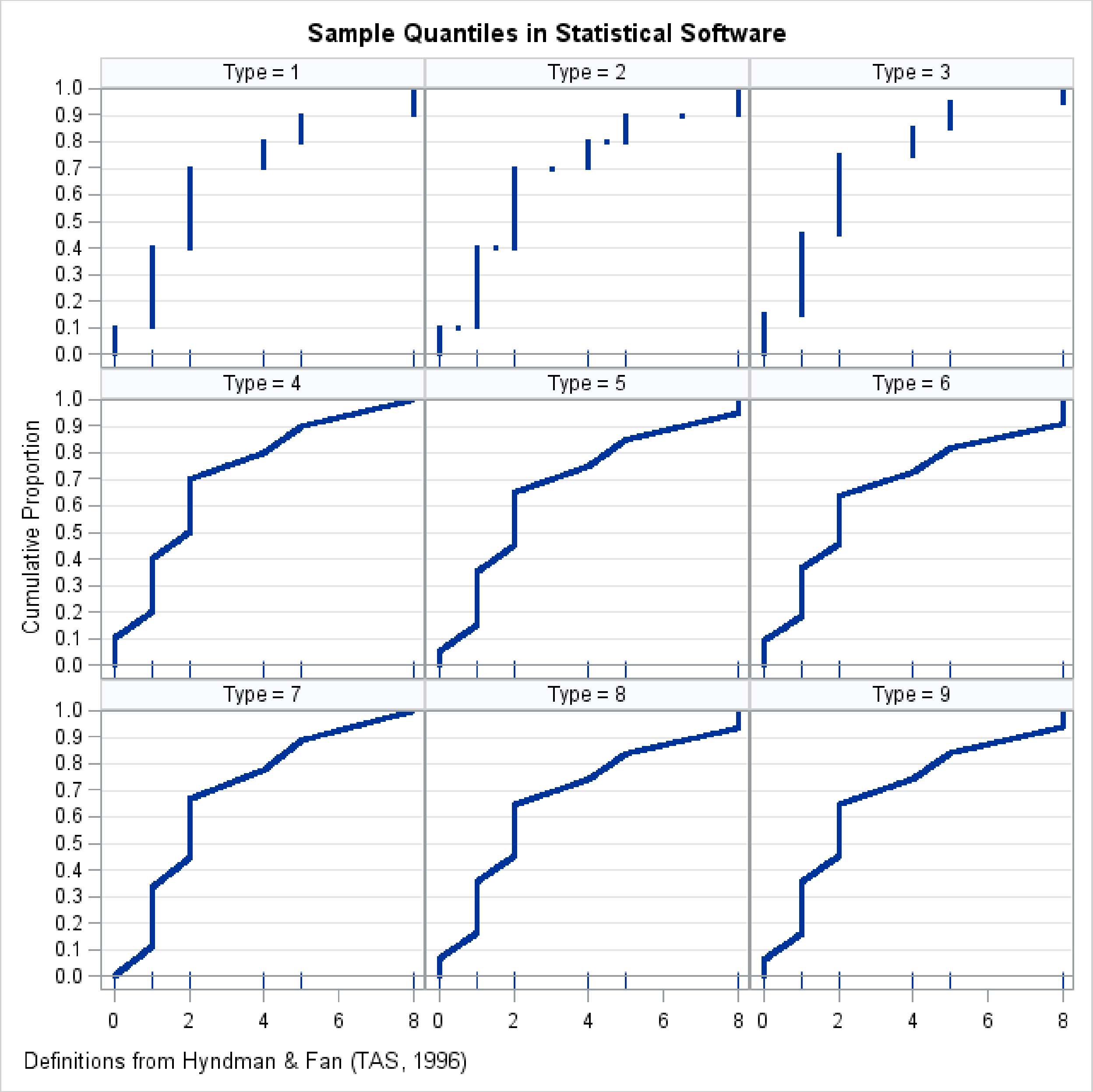


Figure 1: Visualizing the definitions of sample quantiles

Type 1: Inverse of empirical distribution function.

Type 2: Similar to type 1 but with averaging at discontinuities.

Type 3: Nearest even order statistic (SAS default till ca. 2010).

```
sapply(1:9, function(x) quantile(disk_io, c(.1, .9), type = x))
```

```
##     [,1] [,2] [,3] [,4] [,5] [,6] [,7]     [,8] [,9]
## 10%   14   14   13 13.3 13.8 13.4 14.2 13.66667 13.7
## 90%   38   38   38 37.4 38.2 38.6 37.6 38.33333 38.3
```

The $a - quantile$ is the $[(n-1)a+1]$th element.

So the type we want is 1:

```
quantile(disk_io, c(.1, .9), type = 1)
```

```
## 10% 90%
##  14  38
```

```

mean(disk_io)
```

b. What is the mean number of disk I/O's per program?

```
## [1] 26.90909
```

```

x <- mean(disk_io)
s <- sd(disk_io)
n <- length(disk_io)
a <- 1 - 90/100
z <- 1.645

# book solution = (24.18, 29.64)
c(x - z*s/sqrt(n), x + z*s/sqrt(n))
```

c. What is the 90% confidence interval for the mean?

```
## [1] 24.19023 29.62795
```