Measures of Dispersion

Ungrouped data

```
x=c(1.2, 1.4, 1.3, 1.6, 1.0, 1.5, 1.7, 1.1, 1.2, 1.3)
summary(x)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
  1.000   1.200   1.300   1.330   1.475   1.700 
```

```
#Range
rg=max(x)-min(x)
rg
```

```
[1] 0.7
```

```
#Interquartile Range
iqr=quantile(x,0.75)-quantile(x,0.25)
iqr
```

```
  75% 
0.275 
```

```
#Semi Interquartile Range
siqr=iqr/2
siqr
```

```
   75% 
0.1375 
```

```
#Coefficient of quartile deviation
cqd=(quantile(x,0.75)-quantile(x,0.25))/(quantile(x,0.75)+quantile(x,0.25))
cqd
```

```
      75% 
0.1028037 
```

```
#Variance
v=var(x)
n=length(x)
vr=v*(n-1)/n #according to stat formula
vr
```

```
[1] 0.0441
```

```r
#standard deviation
sd=vr^0.5
sd
```

```
[1] 0.21
```

```r
#Coefficient of variation
cv=sd/mean(x)*100
cv
```

```
[1] 15.78947
```

```r
#Mean deviation about mean
y=(x-mean(x))
y
```

```
 [1] -0.13  0.07 -0.03  0.27 -0.33  0.17  0.37 -0.23 -0.13 -0.03
```

```r
y=abs(y)
y
```

```
 [1] 0.13 0.07 0.03 0.27 0.33 0.17 0.37 0.23 0.13 0.03
```

```r
md1=sum(y)/length(y)
md1
```

```
[1] 0.176
```

```r
#Mean deviation about median
z=abs(x-median(x))
md2=sum(z)/length(z)
md2
```

```
[1] 0.17
```

```r
#Mean deviation about mode
xt=table(x)
xt
```

```
x
  1 1.1 1.2 1.3 1.4 1.5 1.6 1.7
  1   1   2   2   1   1   1   1
```

```r
which(xt==max(xt))
```

```
1.2 1.3
  3   4
```

```
#As mode is not unique for the given data set so can't find mean deviation about mode.
```

Frequency distribution (Discrete data)

```
x=c(0, 1, 2, 3, 4, 7)
f=c(3, 7, 14, 8, 2, 1)
y=rep(x,f)
summary(y)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  0.000   1.000   2.000   2.114   3.000   7.000
```

```
#Range
rg=max(y)-min(y)
rg
```

```
[1] 7
```

```
#Interquartile Range
iqr=quantile(y,0.75)-quantile(y,0.25)
iqr
```

```
75%
  2
```

```
#Semi Interquartile Range
siqr=iqr/2
siqr
```

```
75%
  1
```

```
#Coefficient of quartile deviation
cqd=(quantile(y,0.75)-quantile(y,0.25))/(quantile(y,0.75)+quantile(y,0.25))
cqd
```

```
75%
0.5
```

```
#Variance
v=var(y)
n=length(y)
vr=v*(n-1)/n #according to stat formula
vr
```

```
[1] 1.701224
```

```
#standard deviation
sd=vr^0.5
sd
```

```
[1] 1.30431
```

```
#Coefficient of variation
cv=sd/mean(y)*100
cv
```

```
[1] 61.69034
```

```
#Mean deviation about mean
w=(y-mean(y))
w
```

```
 [1] -2.1142857 -2.1142857 -2.1142857 -1.1142857 -1.1142857 -1.1142857
 [7] -1.1142857 -1.1142857 -1.1142857 -1.1142857 -0.1142857 -0.1142857
[13] -0.1142857 -0.1142857 -0.1142857 -0.1142857 -0.1142857 -0.1142857
[19] -0.1142857 -0.1142857 -0.1142857 -0.1142857 -0.1142857 -0.1142857
[25]  0.8857143  0.8857143  0.8857143  0.8857143  0.8857143  0.8857143
[31]  0.8857143  0.8857143  1.8857143  1.8857143  4.8857143
```

```
w=abs(w)
w
```

```
 [1] 2.1142857 2.1142857 2.1142857 1.1142857 1.1142857 1.1142857 1.1142857
 [8] 1.1142857 1.1142857 1.1142857 0.1142857 0.1142857 0.1142857 0.1142857
[15] 0.1142857 0.1142857 0.1142857 0.1142857 0.1142857 0.1142857 0.1142857
[22] 0.1142857 0.1142857 0.1142857 0.8857143 0.8857143 0.8857143 0.8857143
[29] 0.8857143 0.8857143 0.8857143 0.8857143 1.8857143 1.8857143 4.8857143
```

```
md1=sum(w)/length(y)
md1
```

```
[1] 0.8995918
```

```
#Mean deviation about median
z=abs(y-median(y))
md2=sum(z)/length(z)
md2
```

```
[1] 0.8571429
```

```
#Mean deviation about mode
yt=table(y)
yt
```

```
y
 0  1  2  3  4  7 
 3  7 14  8  2  1 
```

```r
val=which(yt==max(yt))
val
```

```
2
3
```

```r
mode=2
v=abs(y-mode)
md3=sum(v)/n
md3
```

```
[1] 0.8571429
```

Frequency distribution (Continuous data)

```r
cls= c("89.5-99.5","99.5-109.5","109.5-119.5","119.5-129.5","129.5-139.5","139.5-149.5","149.5-159.5","
f=c(5,8,22,27,17,9,5,5,2)
f
```

```
[1]  5  8 22 27 17  9  5  5  2
```

```r
midx=c(seq(94.5,174.5,10))
midx
```

```
[1]  94.5 104.5 114.5 124.5 134.5 144.5 154.5 164.5 174.5
```

```r
fr.dist=data.frame(cls,f,midx)
fr.dist
```

```
          cls  f  midx
1   89.5-99.5  5  94.5
2  99.5-109.5  8 104.5
3 109.5-119.5 22 114.5
4 119.5-129.5 27 124.5
5 129.5-139.5 17 134.5
6 139.5-149.5  9 144.5
7 149.5-159.5  5 154.5
8 159.5-169.5  5 164.5
9 169.5-179.5  2 174.5
```

```r
w=10
n=sum(f)
n
```

```
[1] 100
```

```r
#Range
mn=min(midx)-w/2
mx=max(midx)-w/2
rg=mx-mn
rg
```

```
[1] 80
```

```
cl=cumsum(f)
cl
```

```
[1]   5  13  35  62  79  88  93  98 100
```

```
#Lower quartiles
attach(fr.dist)
```

```
The following objects are masked _by_ .GlobalEnv:

    cls, f, midx
```

```
m1=min(which(cl>=n/4))
m1
```

```
[1] 3
```

```
fr=f[m1]
l=midx[m1]-w/2
c=cl[m1-1]
q1=l+((n/4-c)/fr)*w
q1
```

```
[1] 114.9545
```

```
#upper quartile
m1=min(which(cl>=3*n/4))
m1
```

```
[1] 5
```

```
fr=f[m1]
l=midx[m1]-w/2
c=cl[m1-1]
q3=l+((3*n/4-c)/fr)*w
q3
```

```
[1] 137.1471
```

```
#IQR
iqr=q3-q1
iqr
```

```
[1] 22.19251
```

```
siqr=iqr/2
siqr
```

```
[1] 11.09626
```

```
cqd=iqr/(q3+q1)
cqd
```

```
[1] 0.08803004
```

```
#Mean
mean.x=sum(midx*f)/n
mean.x
```

```
[1] 127.2
```

```
var=sum(f*(midx-mean.x)^2)/n
var
```

```
[1] 319.71
```

```
sd=var^0.5
sd
```

```
[1] 17.88044
```

```
cv=sd/mean.x*100
cv
```

```
[1] 14.05695
```

```
#Mean absolute deviaion about mean
md1=sum(f*abs(midx-mean.x))/n
md1
```

```
[1] 13.948
```

```
#Median
m1=min(which(cl>=n/2))
m1
```

```
[1] 4
```

```
fr=f[m1]
l=midx[m1]-w/2
c=cl[m1-1]
q2=l+((n/2-c)/fr)*w
q2
```

```
[1] 125.0556
```

```
#mean deviation about mean
md2=sum(f*abs(midx-q2))/n
md2
```

```
[1] 13.43333
```

```
#Mode
m1=which(f==max(f))
m1
```

```
[1] 4
```

```
fm=f[m1]
f1=f[m1-1]
f2=f[m1+1]
l=midx[m1]-w/2
mode.x=l+((fm-f1)/(2*fm-f1-f2))*w
mode.x
```

```
[1] 122.8333
```

```
#mean deviation about mode
md3=sum(f*abs(midx-mode.x))/n
md3
```

```
[1] 13.8
```