

Statistical Moments and Measures of Central Tendency

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1 Problem 1: Moments Calculation

Twenty students, both graduates and undergraduates, were enrolled in a statistics course. Their ages were:

18, 19, 19, 19, 19, 20, 20, 20, 20, 20, 21, 21, 21, 21, 22, 23, 24, 27, 30, 36.

Find the moments, β_1 , β_2 , γ_1 , and γ_2 .

```
x<- c(18,19,19,19,19,20,20,20,20,20,21,21,21,21,22,23,24,27,30,36)
moments<-function(x)
{
  l = length(x) # total number of observations
  s = sum(x)
  m1 <- round((s/l),2)
  print(paste("Mean is:", m1))

  m2 <- round((sum((x-m1)^2)/l),2) # Second central moment
  print(paste("Second central moment is:", m2))

  m3<- round((sum((x-m1)^3)/l),2) # Third central moment
  print(paste("Third central moment is:", m3))

  m4<- round((sum((x-m1)^4)/l),2) # Fourth central moment
  print(paste("Fourth central moment is:", m4))

  beta1 <- round((m3^2/m2^3),2)
  print(paste("Beta1 is:", beta1))

  beta2 <- round((m4/m2^2),2)
  print(paste("Beta2 is:", beta2))

  gamma1 <- round(sqrt(beta1),2)
```

```

print(paste("Gamma1 is:", gamma1))

gamma2 <- round((beta2-3),2)
print(paste("Gamma2 is:", gamma2))
}
moments(x)

## [1] "Mean is: 22"
## [1] "Second central moment is: 18.3"
## [1] "Third central moment is: 158.7"
## [1] "Fourth central moment is: 2190.9"
## [1] "Beta1 is: 4.11"
## [1] "Beta2 is: 6.54"
## [1] "Gamma1 is: 2.03"
## [1] "Gamma2 is: 3.54"

```

2 Problem 2: Measures of Central Tendency for a Frequency Table

A survey of 25 faculty members in a college was conducted to study their vocational mobility. They were asked:

"In addition to your present position, at how many educational institutes have you served on the faculty?"

The frequency distribution of their responses is as follows:

x	0	1	2	3
f	8	11	5	1

Find the mean and median of the distribution.

```

moment<-function(x,f)
{
  sum_xifi<- sum(x*f)
  sum_fi<- sum(f)
  mean<- sum_xifi/sum_fi
  print(paste("Mean is:", mean))
}

x<-c(0,1,2,3)
f<-c(8,11,5,1)
moment(x,f)

## [1] "Mean is: 0.96"

```

3 Problem 3: Moments for Continuous Variables

```
moments_cont <- function(l,u,f) # Lower bound, upper bound, frequency
{
  mid <- (l+u)/2
  len<-sum(f)
  s<- sum(mid*f)
  mean<- round((s/len),2)
  print(paste("Mean is:", mean))

  m2 <- round((sum(((mid-mean)^2*f))/len),2) # Second order moment
  print(paste("Second central moment is:", m2))

  m3<- round((sum(((mid-mean)^3*f))/len),2) # Third order moment
  print(paste("Third central moment is:", m3))

  m4<- round((sum(((mid-mean)^4*f))/len),2) # Fourth order moment
  print(paste("Fourth central moment is:", m4))

  beta1 <- round((m3^2/m2^3),2)
  print(paste("Beta1 is:", beta1))

  beta2 <- round((m4/m2^2),2)
  print(paste("Beta2 is:", beta2))

  gamma1 <- round(sqrt(beta1),2)
  print(paste("Gamma1 is:", gamma1))

  gamma2 <- round((beta2-3),2)
  print(paste("Gamma2 is:", gamma2))
}

l<- c(145,150,155,160,165,170,175,180)
u<- c(150,155,160,165,170,175,180,185)
f<-c(4,6,28,58,64,30,5,5)
moments_cont(l,u,f)

## [1] "Mean is: 165.18"
## [1] "Second central moment is: 42.47"
## [1] "Third central moment is: -1.22"
## [1] "Fourth central moment is: 6497.31"
## [1] "Beta1 is: 0"
## [1] "Beta2 is: 3.6"
## [1] "Gamma1 is: 0"
```

```
## [1] "Gamma2 is: 0.6"
```