Week 1 R Challenge Answer

2024-04-05

The Challenge:

Write a function that uses a Riemann Sum to correctly estimate π to at least 5 correct decimals: 3.14159

Ideally, you are combining your knowledge of algebra, geometry, and R loops to estimate π.

You may *not* use any packages outside of base R, or any trigonometric functions or other pre-existing R functions that have π *baked* into them.

My Solution:

We know that $x^2 + y^2 = 1$ forms a circle of radius 1 and area π.

Estimate the area between 0 and 1 under the curve of $y = \sqrt{1 - x^2}$ using a Riemann Sum. Call this area A. Therefore we estimate π as

$$\pi \approx 4A$$

```r
# Function for y = \sqrt{1 - x^2}
quart_circ = function(x) {

  y = sqrt(1 - x^2)

  return(y)
}



# Riemann Sum Estimator
riemann_sum = function(n) {
  # n tells us the number of steps to take

  steps = seq(from = 0, to = 1, by = 1/n)

  area_data = rep(NA, n)

  for (i in 1:n) {
    # what is y for a given x?
    y = quart_circ(steps[i])

    # multiply to get area of rectangle, and save area
    area_data[i] = y*(1/n)
  }

  pi = 4*sum(area_data)

  return(pi)
```

```
}
```

```
riemann_sum(1000000)
```

```
## [1] 3.141595
```