Random_Walks.R

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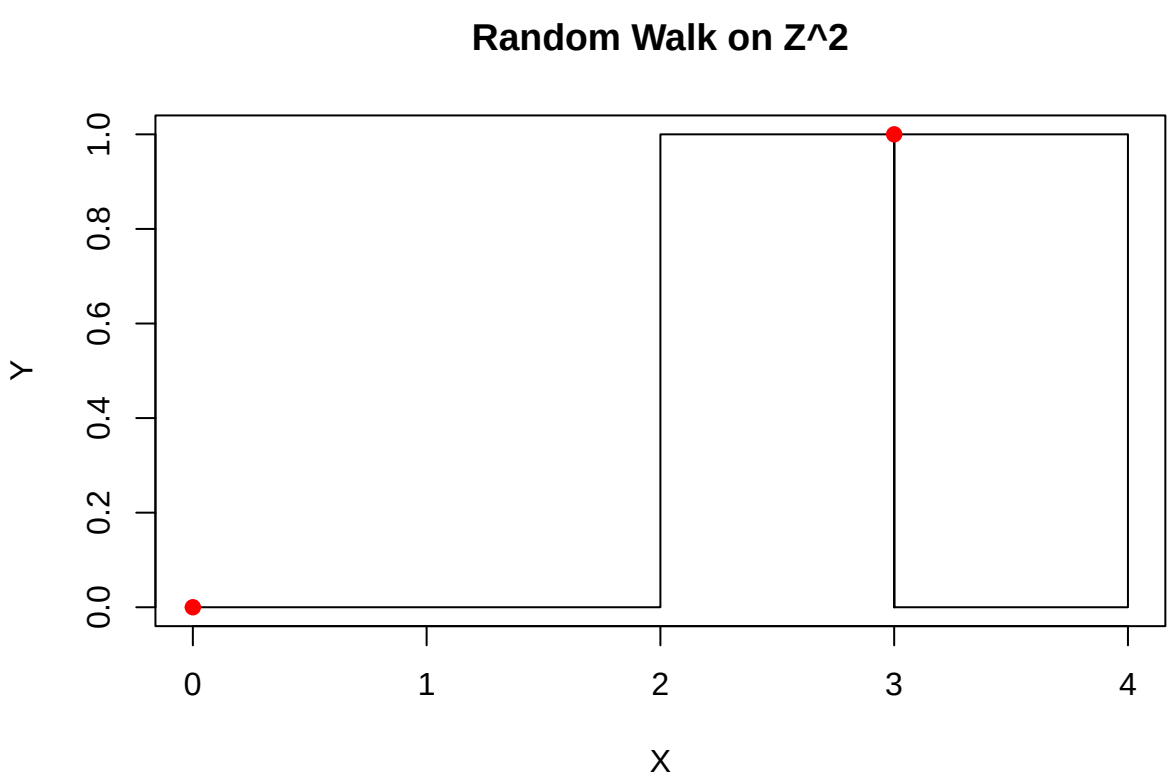
```r
# (a)
x <- 0
y <- 0
range_x <- c(0)
range_y <- c(0)
movements <- c("up", "down", "left", "right")

for (i in 1:10) {
  direction <- sample(movements, 1)

  if (direction == "up") {
    y <- y + 1
  } else if (direction == "down") {
    y <- y - 1
  } else if (direction == "left") {
    x <- x - 1
  } else if (direction == "right") {
    x <- x + 1
  }

  range_x <- c(range_x, x)
  range_y <- c(range_y, y)
}

plot(range_x, range_y, type="l", col="black", xlab="X", ylab="Y", main="Random Walk on Z^2")
points(x,y, col = "red", pch=19)
points(0,0, col = "red", pch=19)
```




```r
# (b)
x <- 0
y <- 0
range_x <- c(0)
range_y <- c(0)
movements <- c("up", "down", "left", "right")

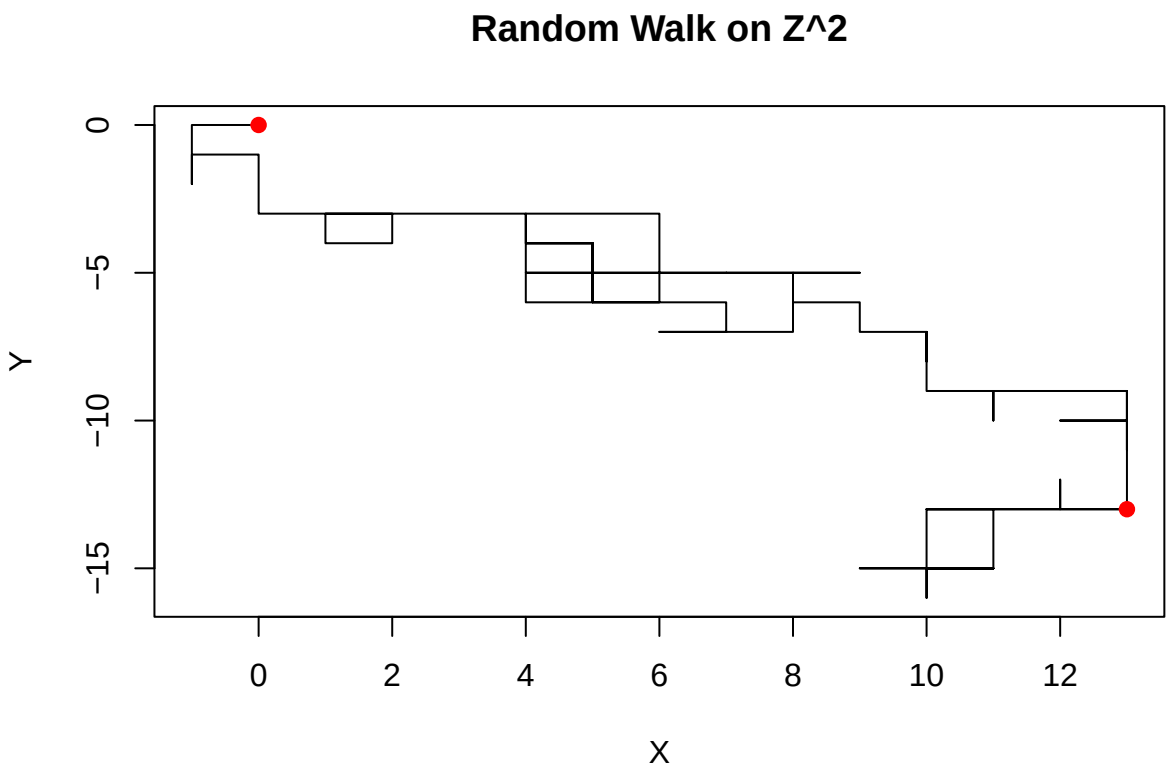
for (i in 1:100) {
  direction <- sample(movements, 1)

  if (direction == "up") {
    y <- y + 1
  } else if (direction == "down") {
    y <- y - 1
  } else if (direction == "left") {
    x <- x - 1
  } else if (direction == "right") {
    x <- x + 1
  }

  range_x <- c(range_x, x)
  range_y <- c(range_y, y)
}

plot(range_x, range_y, type="l", col="black", xlab="X", ylab="Y", main="Random Walk on Z^2")
points(x,y, col = "red", pch=19)
```

```
points(0,0, col = "red", pch=19)
```




```
# (c)
x <- 0
y <- 0
range_x <- c(0)
range_y <- c(0)
movements <- c("up", "down", "left", "right")
distance <- 0

for (i in 1:10000) {
  direction <- sample(movements, 1)

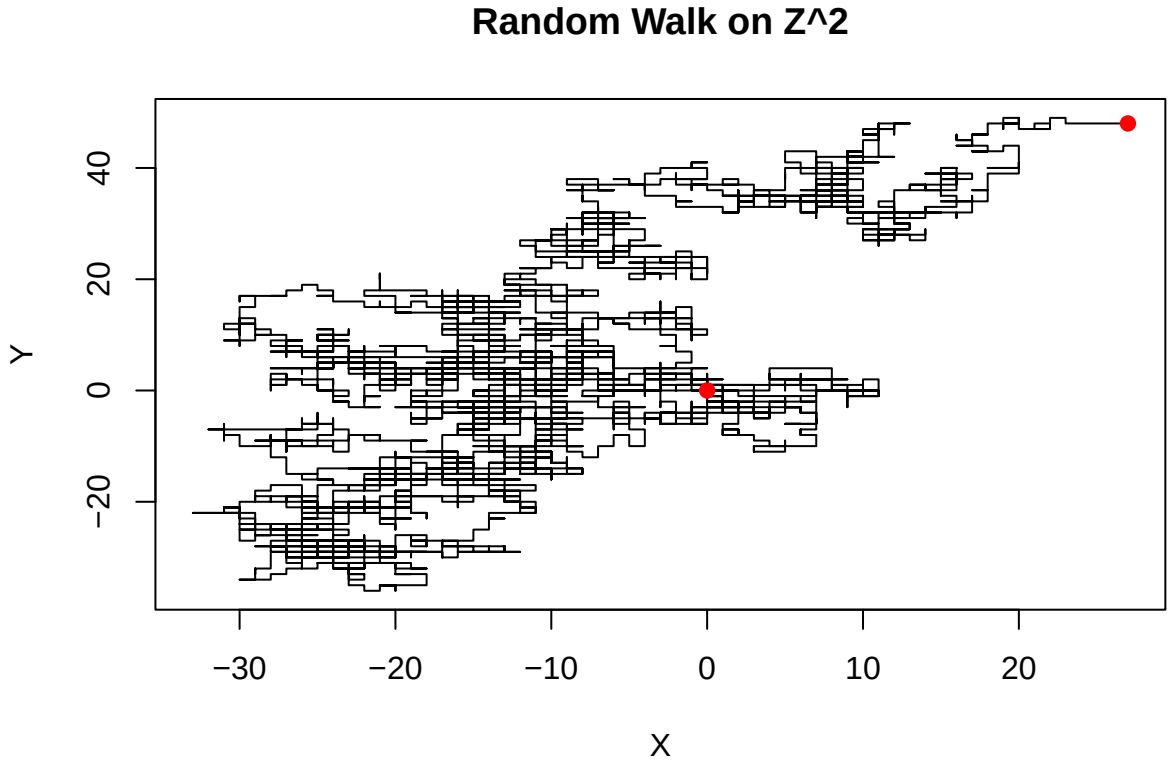
  if (direction == "up") {
    y <- y + 1
  } else if (direction == "down") {
    y <- y - 1
  } else if (direction == "left") {
    x <- x - 1
  } else if (direction == "right") {
    x <- x + 1
  }

  range_x <- c(range_x, x)
  range_y <- c(range_y, y)
```

```
  distance <- sqrt(x^2 + y^2)

  if (distance >= 55) {
    break
  }
}

plot(range_x, range_y, type="l", col="black", xlab="X", ylab="Y", main="Random Walk on Z^2")
points(x,y, col = "red", pch=19)
points(0,0, col = "red", pch=19)
```




```
# (d)
x <- 55
y <- 0
range_x <- c(55)
range_y <- c(0)
movements <- c("up", "down", "left", "right")

for (i in 1:10000) {
  direction <- sample(movements, 1)

  if (direction == "up") {
    y <- y + 1
  } else if (direction == "down") {
    y <- y - 1
```

```
  } else if (direction == "left") {
    x <- x - 1
  } else if (direction == "right") {
    x <- x + 1
  }

  range_x <- c(range_x, x)
  range_y <- c(range_y, y)

  if(x == 0 && y == 0){
    break
  }
}

plot(range_x, range_y, type="l", col="black", xlab="X", ylab="Y", main="Random Walk on Z^2")
points(x,y, col = "red", pch=19)
points(55,0, col = "red", pch=19)
```

