Snakes and Ladders

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Snakes and Ladders

```
roll.die <- function(){
  return(sample(size=1,1:6))
}
```

```
initialize.board <- function(dim, n.ladders, n.snakes){
  set.seed(47)

  spaces <- dim^2

  occupied <- c()

  ladder.starts <- sample(size=10,1:(spaces-dim),replace=FALSE)
  occupied <- c(occupied,ladder.starts)

  ladder.ends <- c()
  for(i in 1:n.ladders){
    le <- ceiling(ladder.starts[i]/dim)*dim # ensures ladder ends at least one row above
    m <- min(40,spaces-1-le)
    end <- le+sample(size=1,1:m)
    while(end %in% occupied){
      end <- le+sample(size=1,1:m)
    }
    occupied <- c(occupied, end)
    ladder.ends <- c(ladder.ends,end)
  }

  snakes.starts <- c()
  for(i in 1:n.snakes){
    ss <- sample(size=1,(dim+1):(spaces-1),replace=FALSE)
    while(ss %in% occupied){
      ss <- sample(size=1,11:99,replace=FALSE)
    }
    occupied <- c(occupied, ss)
    snakes.starts <- c(snakes.starts,ss)
  }

  snakes.ends <- c()
  for(i in 1:n.snakes){
    se <- floor(snakes.starts[i]/dim)*dim # ensures snake ends at least one row below
    m <- min(40,se)
    end <- se-sample(size=1,0:m)
    while(end %in% occupied){
```

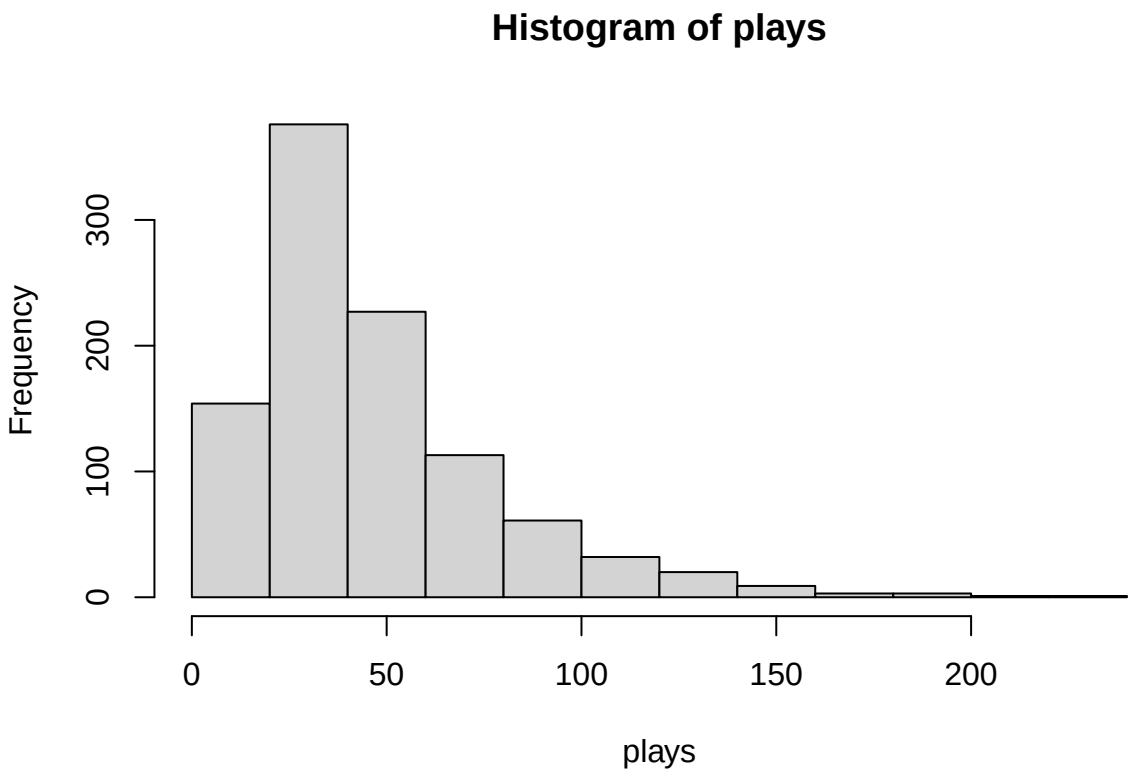
```
      end <- se-sample(size=1,0:m)
    }
    occupied <- c(occupied, end)
    snakes.ends <- c(snakes.ends,end)
  }

  ladders <- data.frame(ladder.starts,ladder.ends)
  snakes <- data.frame(snakes.starts,snakes.ends)

  return(list(dim=dim,ladders=ladders,snakes=snakes))

}
```

```
play.turn <- function(state,board){

  ladders <- board$ladders
  snakes <- board$snakes

  state <- state + roll.die()

  if(state %in% ladders[,1]){
    state <- ladders[which(ladders[,1] == state),2]
  }
  else if(state %in% snakes[,1]){
    state <- snakes[which(snakes[,1] == state),2]
  }

  return(state)

}
```

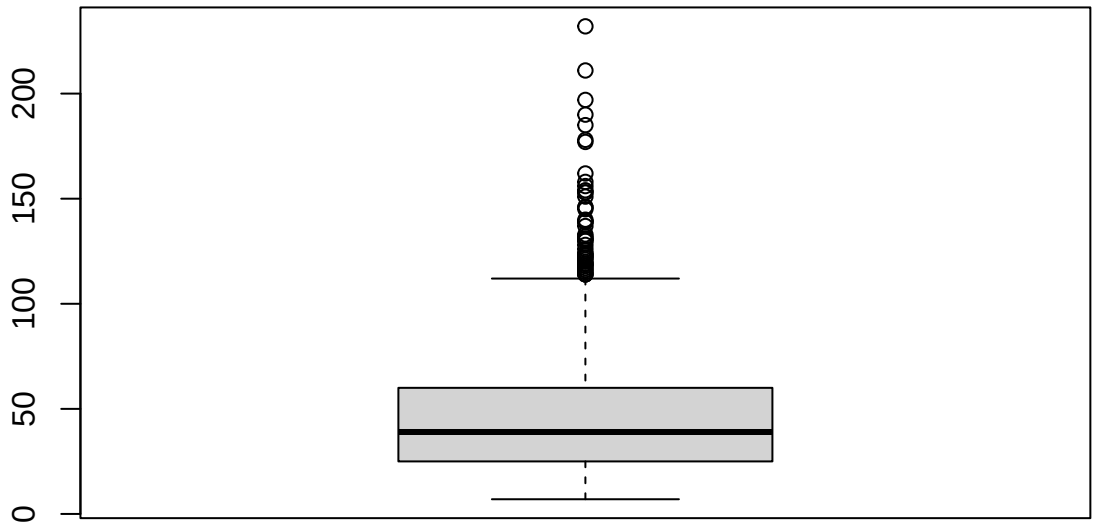
```
play <- function(board){

  state <- 0
  turns <- 0

  while(state < (board$dim)^2){

    state <- play.turn(state,board)
    turns <- turns+1

  }

  return(turns)
}
```

```
board <- initialize.board(10,10,10)

plays <- c()
for(i in 1:1000){
  plays <- c(plays,play(board))
}
```

```
hist(plays)
```




```
boxplot(plays)
```



other functions

```
rand.ladders <- function(n.ladders){
  set.seed(47)

  ladder.starts <- sample(size=10,1:90,replace=FALSE)

  ladder.ends <- c()

  for(i in 1:n.ladders){
    le <- ceiling(ladder.starts[i]/10)*10 # ensures ladder ends at least one row above
    m <- min(40,99-le)
    ladder.ends <- c(ladder.ends,le+sample(size=1,1:m))
  }

  ladders <- data.frame(ladder.starts,ladder.ends)

  return(ladders)
}

rand.snakes <- function(n.snakes){
  set.seed(47)

  snakes.starts <- sample(size=10,11:99,replace=FALSE)

  snakes.ends <- c()
```

```
  for(i in 1:n.snakes){
    se <- floor(snakes.starts[i]/10)*10 # ensures snake ends at least one row below
    m <- min(40,se)
    snakes.ends <- c(snakes.ends,se-sample(size=1,0:m))
  }

  snakes <- data.frame(snakes.starts,snakes.ends)

  return(snakes)
}
```