Untitled

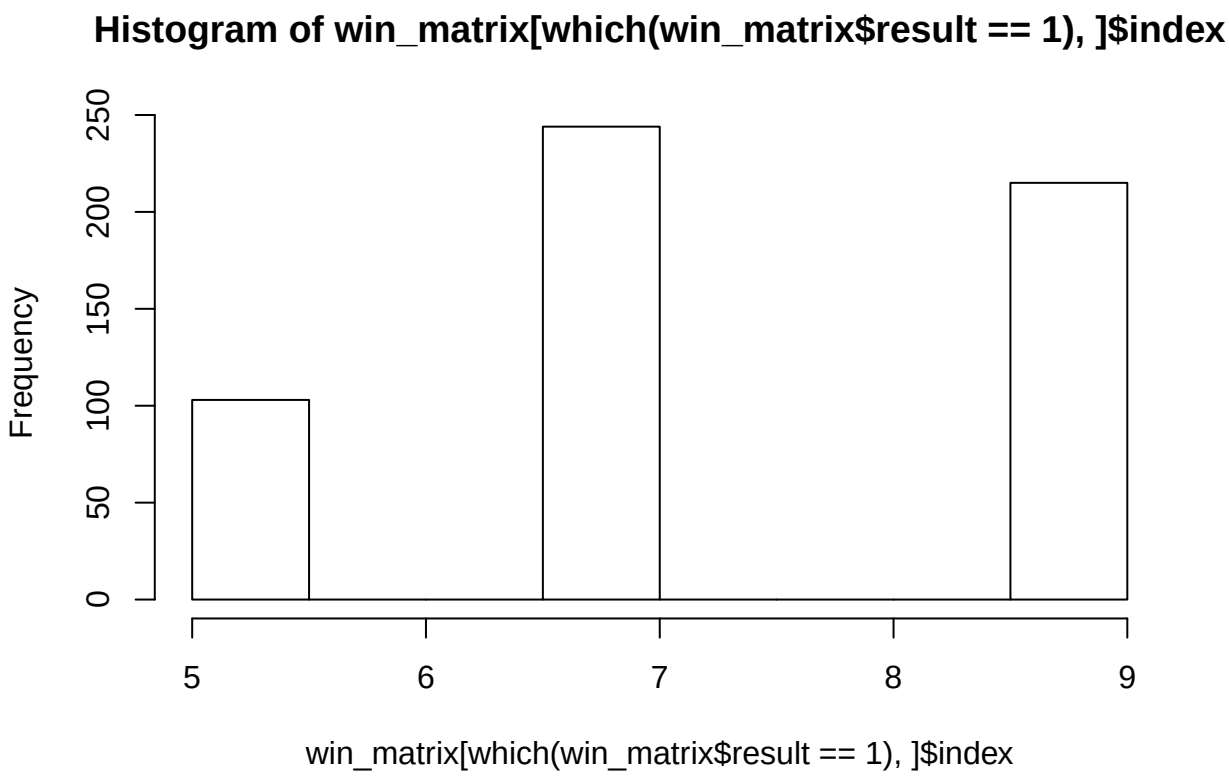
```
library(combinat)
```

```
##
## Attaching package: 'combinat'
```

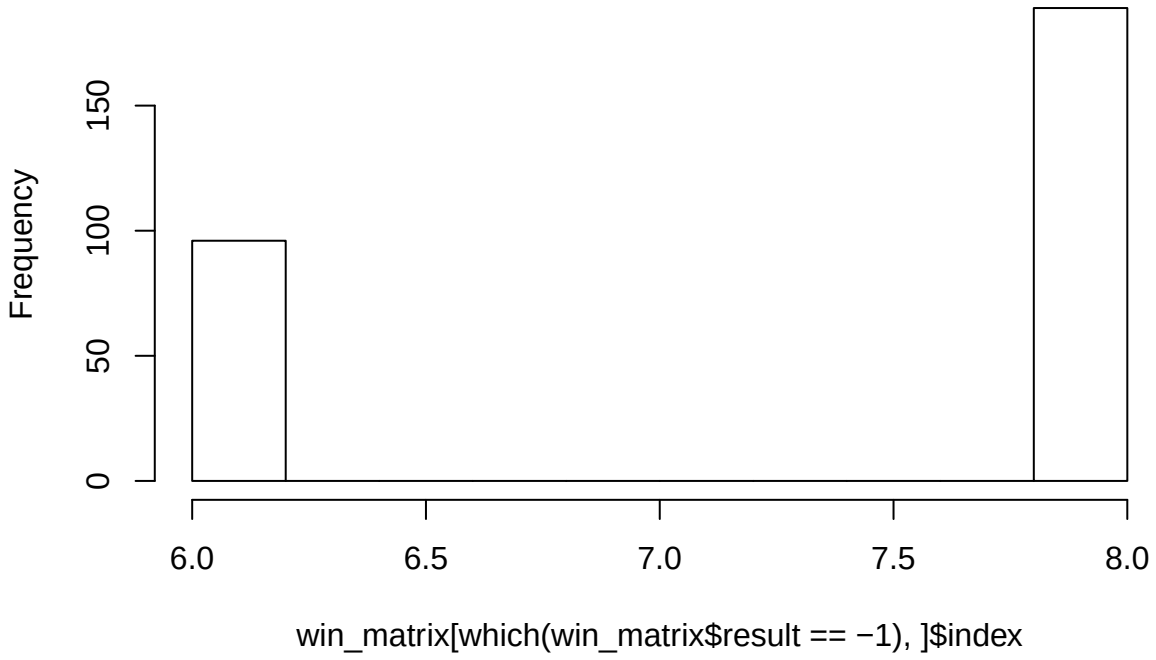
```
## The following object is masked from 'package:utils':
##
##     combn
```

```
library(purrr)

flag <- array(9,0)

win_set <- matrix(c(1,2,3,4,5,6,7,8,9,1,4,7,2,5,8,3,6,9,1,5,9,3,5,7),
                  byrow = F,nrow = 3)

flag[sample(1:9,1)]=1


rand_strategy <- function(){
  flag <- rep(0,9)
  code <- 0
  players <- matrix(data=0,nrow = 5,ncol = 2)
  for(i in 1:9){
    play <- sample(1:9,1)
    while(flag[play]==1){
      play <- sample(1:9,1)
    }
    players[((i-1)/2+1),ifelse((i%%2)==1,1,2)] = play;
    flag[play]=1;
    if(i>4){
      result <- check_win(players,i)
      if(result$code != 0){
        return(result)
      }
    }
  }
  return(result)
}

check_win <-function(players,ind){
  code <- 0
  ifelse(ind%%2==1,index <- 1,index <- 2)
  player_i <- sort(players[,index])
  player_i <- player_i[! player_i %in% c(0)]
  player_i_matrix <- combn(player_i,3)
  if(length(player_i) == 3){
    player_i_matrix <- matrix(player_i,ncol = 1)
  }
  for(i in 1:dim(win_set)[2]){
    for(j in 1:dim(player_i_matrix)[2]){
```

```
      match_vector <- match(win_set[,i],player_i_matrix[,j])
      if(any(is.na(match_vector)) == FALSE){
        ifelse(ind%%2==1,code <- 1,code <- -1)
        return(data.frame(code=code,index=ind))
      }
    }
  }
  return(data.frame(code=code,index=ind))
}
win_rate <- rerun(1000,rand_strategy())
win_matrix <- data.frame(matrix(unlist(win_rate), nrow=1000, byrow=T))
names(win_matrix) <- c('result','index')
hist(win_matrix[which(win_matrix$result==1),]$index)
```




```
hist(win_matrix[which(win_matrix$result==-1),]$index)
```




```
strategy_player_1 <- function(){
  flag <- rep(0,9)
  code <- 0
  players <- matrix(data=0,nrow = 5,ncol = 2)
  for(i in 1:9){
    if(i%%2 == 0 | i==9){
      #player 2 going for random choice
      play <- sample(1:9,1)
      while(flag[play]==1){
        play <- sample(1:9,1)
      }
    }else{
      #player 1
      play <- strategy_move_p1(players,i)
    }
    players[((i-1)/2+1),ifelse((i%%2)==1,1,2)] = play;
    flag[play]=1;
    if(i>4){
      result <- check_win(players,i)
      if(result$code != 0){
        return(result)
      }
    }
  }
  return(result)
}

strategy_move_p1 <- function(players,ind){
  if(ind==1){
```

```
  p1_move <- 5
}else if(ind == 3){
  p2_move <- players[1,2]
  if(p2_move == 2 | p2_move == 4 | p2_move == 6 | p2_move == 8){
    #p2 has chosen the outer middle spot
    if(p2_move == 2){
      p1_move <- 9
    }else if(p2_move == 4){
      p1_move <- 3
    }else if(p2_move == 6){
      p1_move <- 7
    }else{
      p1_move <- 1
    }
  }else{
    #p2 has chosen the outer corner spot
    if(p2_move == 1 | p2_move == 9){
      p1_move <- 3
    }else if(p2_move == 3 | p2_move == 7){
      p1_move <- 1
    }
  }
}else if(ind==5){
  p2_move1 <- players[1,2]
  p2_move2 <- players[2,2]
  if(p2_move1 == 2 | p2_move1 == 4 | p2_move1 == 6 | p2_move1 == 8){
    #p2 has chosen the outer middle spot
    if(p2_move1 == 2){
      if(p2_move2 != 1){
        p1_move <- 1
      }else{
        p1_move <- 3
      }
    }else if(p2_move1 == 4){
      if(p2_move2 != 7){
        p1_move <- 7
      }else{
        p1_move <- 1
      }
    }else if(p2_move1 == 6){
      if(p2_move2 != 3){
        p1_move <- 3
      }else{
        p1_move <- 9
      }
    }else{
      if(p2_move2 != 9){
        p1_move <- 9
      }else{
        p1_move <- 7
      }
    }
  }else{
```

```
    #p2 has chosen the outer corner spot
    if(p2_move1 == 1 | p2_move1 == 9){
      if(p2_move2 != 7){
        p1_move <- 7
      }else{
        if(p2_move1 == 1){
          p1_move <- 4
        }else{
          p1_move <- 8
        }
      }
    }else if(p2_move1 == 3 | p2_move1 == 7){
      if(p2_move2 != 9){
        p1_move <- 9
      }else{
        if(p2_move1 == 3){
          p1_move <- 6
        }else{
          p1_move <- 8
        }
      }
    }
  }
}else if(ind==7){
  p2_move1 <- players[1,2]
  p2_move2 <- players[2,2]
  p2_move3 <- players[3,2]
  if(p2_move1 == 2 | p2_move1 == 4 | p2_move1 == 6 | p2_move1 == 8){
    if(p2_move1 == 2){
      if(p2_move2 == 1){
        if(p2_move3 != 7){
          p1_move <- 7
        }else{
          p1_move <- 6
        }
      }
    }else if(p2_move1 == 4){
      if(p2_move2 == 7){
        if(p2_move3 != 9){
          p1_move <- 9
        }else{
          p1_move <- 2
        }
      }
    }else if(p2_move1 == 6){
      if(p2_move2 == 3){
        if(p2_move3 != 1){
          p1_move <- 1
        }else{
          p1_move <- 8
        }
      }
    }else{
```

```
        if(p2_move2 == 9){
          if(p2_move3 != 3){
            p1_move <- 3
          }else{
            p1_move <- 4
          }
        }
      }
    }else{
      #p2 has chosen the outer corner spot
      if(p2_move1 == 1){
        if(p2_move2 == 7){
          if(p2_move3 != 6){
            p1_move <- 6
          }else{
            p1_move <- 2
          }
        }
      }else if(p2_move1 == 3){
        if(p2_move2 == 9){
          if(p2_move3 != 4){
            p1_move <- 4
          }else{
            p1_move <- 2
          }
        }
      }else if(p2_move1 == 7){
        if(p2_move2 == 9){
          if(p2_move3 != 2){
            p1_move <- 2
          }else{
            p1_move <- 4
          }
        }
      }else if(p2_move1 == 9){
        if(p2_move2 == 7){
          if(p2_move3 != 2){
            p1_move <- 2
          }else{
            p1_move <- 4
          }
        }
      }
    }
  }
  p1_move
}

win_rate <- rerun(1000,strategy_player_1())
win_matrix <- data.frame(matrix(unlist(win_rate), nrow=1000, byrow=T))
names(win_matrix) <- c('result','index')
table(win_matrix[which(win_matrix$result==1),]$index)
```

```
##
```

```
##   5   7   9
## 851 139   5
```

```
table(win_matrix$result)
```

```
##
##   0   1
##   5 995
```

```
hist(win_matrix[which(win_matrix$result==1),]$index)
```